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CONTENTS

	Page
On Forecasting Winds [illegible] Washington, D. C. [illegible]	283
Meteorological [illegible] Data:	
Aerological Observations	285
River [illegible]	285
Climatological [illegible]	285
Special Articles	287
Solar Radiation Data:	
Solar Radiation Observations	275
Charts I-XI	
(Chart VII, Snowfall, omitted until November.)	

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Tables 3 and 4 of [illegible] dated for July 1948 were erroneously included under the heading "Less Solar Radiation Data for June 1948."

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ON FORECASTING WINTER PRECIPITATION AMOUNTS AT WASHINGTON, D. C.

R. R. RAPP [1]

[U. S. Weather Bureau, Washington, D. C.]

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ABSTRACT

A simplified model of the rainfall mechanism is used as a guide in developing a statistical formula, with readily measured variables as arguments, for forecasting precipitation amounts in winter at Washington, D. C. The skill of the forecasting method is tested on independent data and for snow cases. To simplify computations involved in using the formula, a nomograph is devised. Suggestions are given for further work on the method.

INTRODUCTION

This study is aimed at developing a logical method of forecasting the amount of precipitation that will fall at Washington, D. C. The technique employed is to use a simplified model of the rainfall mechanism as a guide in developing a statistical forecasting formula which uses readily measured variables as arguments. Only the winter season is treated and the forecast is for the period 0800 to 2000 EST, the forecast period usually termed "today". The data used in making the forecast are restricted to those available to the forecaster at 0130 EST; the precipitation amount referred to is that recorded in inches by the rain gage at Washington National Airport during the period for which the forecast is made.

THEORETICAL BACKGROUND

The exact mechanism by which moisture is condensed and precipitated from the atmosphere is not completely understood. Fulks [1] analyzed a situation in which it was assumed that all condensed water was precipitated and that the vertical velocity and the vertical distribution of moisture were known. The derivation is admittedly an over-simplified one which ignores the problems of the variation in intensity of precipitation and the controversial subject of colloidal instability, as well as the problem of evaporation. Nevertheless, Fulks' work provides a starting point in devising a systematic method for forecasting precipitation. Holmboe, Forsythe, and Gustin [2] present an excellent re-analysis of Fulks' work. They set forth the following formula for computing the rate of precipitation in millimeters per hour:

$$\textit{Precipitation rate} = \sum_{H_1}^{H_2} WP \frac{\Delta H}{100}$$

W is the average vertical velocity through a saturated layer of air.

P is the rate of precipitation from a saturated layer of air ascending with a unit of vertical velocity and is essentially a function of the pressure and mixing ratio.

ΔH is the thickness of a sublayer of saturated air.

H_1 and H_2 are the lower and upper heights respectively, of the layer over which the quantity $WP \frac{\Delta H}{100}$ is summed.

Since only the form of this equation is considered in this study, and no computations are made, it is not necessary to enter into any discussion of units.

The form of this equation indicates that the precipitation is a function of the amount of moisture available and the vertical velocity of the air. Fletcher [3] and Showalter [4] have suggested formulae similar to this in studies of precipitation amounts. Realistic computations of the concurrent vertical velocity are not feasible, and it would be impractical to compute, from theory now available, a forecast of the vertical velocity. The problem of making a forecast of the distribution of moisture and the layers where the air will be saturated is fully as difficult as the problem of forecasting vertical velocity. In order to circumvent these theoretical difficulties the statistical approach may be used; that is, variables which should be related to P and W may be measured from weather charts and correlated with precipitation amounts in the manner suggested by the formula.

TYPING SYSTEM

In order to reduce the number of cases to be handled in the statistical analysis of the data, a typing system was devised. The first factor to be considered, following Brier [5], was the occurrence or nonoccurrence of precipitation upstream from Washington. This denotes the presence or absence of a precipitation mechanism in a position from which it is likely to move toward Washington. On the original sample of data selected for study, there were 113 cases in which the 700-mb. contour through Washington did not cross over a rain area on the surface map between a point 2° of latitude upstream from Washington and 95° west longitude. Of these 113 cases, 108 did not result in precipitation at Washington during the specified forecast period. The heaviest amount among the 5 cases which did result in precipitation showed east-

[1] Now at New York University, New York, N. Y.

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erly flow at the surface at Washington and southerly flow aloft, a condition that Brier found very useful in predicting Washington winter precipitation. The data were therefore divided into two types by the following criteria.

Precipitation Type.—The upwind extension of the 700 mb. contour line through Washington crosses an active precipitation area on the 0130 EST surface map between a point 2° upwind and 95° west longitude, or a combination of an easterly surface wind with a southerly 700 mb. wind is found at Washington.

No-precipitation Type.—Neither of the above conditions is met.

In the No-precipitation Type only 3.6 percent of the cases resulted in precipitation during the forecast period and therefore this type was not further considered. The Precipitation Type was characterized by resultant precipitation in 45.5 percent of the cases and is the type for which a statistical formula was developed.

VARIABLES

The next step was the selection of readily measured variables that are related to P and W in Fulks' formula. P is essentially a function of pressure and mixing ratio [2]; it is a single valued function of the mixing ratio at constant pressure. If it is assumed that the mixing ratio at some constant pressure surface is a good index of the moisture in the saturated layer, and if a scheme could be devised to locate a point where this mixing ratio would represent the air crossing a station during a given period, the mixing ratio could be combined with a measure of the vertical velocity to yield an estimate of the precipitation to be expected.

In order to estimate this mixing ratio, a variable Q was defined by the following procedure. The geostrophic wind at the 700 mb. surface was computed at Washington. A distance equal to 12 hours' travel at this speed was measured along the upstream extension of the 700-mb. contour line through Washington. If there was obviously a large change in gradient upstream from Washington, the 12 hours' travel was computed in two steps using 6 hours' travel distance from Washington to a point, and then measuring 6 hours' travel distance farther upstream at the rate of the current geostrophic wind computed at that point. The mixing ratio at 850 mb. was read under the upwind terminus of the 700-mb. 12-hour geostrophic travel; this mixing ratio is the variable Q. The process of moving upstream a distance equal to 12 hours' travel and then using the mixing ratio under that point gives an approximation of the three-dimensional trajectory of the air. The variable Q is directly proportional to P, since it is a mixing ratio measured in a constant pressure surface.

In a paper on vertical velocity Miller [6] shows that there is a correlation between the southerly horizontal wind component and the vertical motion. As a measure of the vertical motion to be expected at Washington the variable G was devised. G is defined by $\frac{Z_{CHS}-Z_{\min}}{D}$ where Z_{CHS} is the height of the 850 mb. surface over Charleston, S. C., $Z_{\min}$ is the lowest height of the 850 mb. surface along a line between Charleston and Little Rock, Ark., except that when Charleston reports the lowest pressure along the line, the height at Little Rock is used as $Z_{\min}$. D is the distance from Charleston to the point of $Z_{\min}$. G is expressed in tens of feet per degree of latitude, and as a measure of southerly wind component should be related to the vertical velocity in such a manner that large positive values of G correspond to large upward velocities.

Another variable, useful in estimating the expected vertical velocity, was considered advisable. In a study of Washington winter precipitation Brier [5] used a variable that he denoted by L. This variable is the lowest latitude reached by the upwind extension of the 700-mb. contour line through Washington between WA and 95° west longitude, except that if WA is at the point of lowest latitude, L is defined as the latitude of the intersection of the contour line through Washington and 95° west longitude. It is measured in degrees of latitude from the equator. The success of this variable is, at least in part, due to the fact that it measures the southerly component of the wind to be expected at Washington, and hence is a measure of the vertical velocity. Since the southerly component will be greatest when the latitude is lowest, L should be related to the vertical velocity in such a manner that small values of L correspond to large upward velocities.

There is no variable in this study to measure the thickness of the saturated layer, ΔH. This may reduce the effectiveness of the system; however, since the variables are approximations, it is felt that the lack of such a measure will not materially affect the results.

FORM OF RELATIONSHIP

Two variables, $1/L$ and G, have been defined which should be proportional to the vertical velocity over Washington during the forecast period. The assumption that these should be combined as a weighted mean seems to be most consistent as an approximation of W which is defined as the mean vertical velocity of the saturated layer. From Fulks' formula it can be seen that Q should be multiplied by the vertical velocity term. Thus, considering the forecast period as a unit of time,

$$\textit{Precipitation} \propto Q(1/L+G)$$

Realizing that the vertical velocity components should probably not be equally weighted, and that constants of conversion and proportionality are involved, the formula,

$$\textit{Precipitation}=a+b\ Q/L+cQG$$

was fitted to the data for the two winters 1944–45 and 1945–46. The mathematical fit by the least squares method yielded the following values for a, b, and c:

$a=-.066$ inches
$b=1.57$ inches$\times$degrees latitude
$c=.0055$ inches$\times$degrees latitude/10's of feet.

These constants give a forecast in inches of precipitation for the period. When the results of applying this formula to the Precipitation Type of the original data were broken down into categorical forecasts, it was found that it showed little skill in separating the rain amounts within categories. See table 1.

A plot of the values of Q/L against QG (fig. 1) with precipitation values entered in the body of the chart indicates that a better job may be done on the categorical forecasts.

Whereas the least square fit reduces the square of the errors to a minimum, it is not necessarily the best forecast equation. It is desirable to minimize the error, but for large errors, it makes little difference if the error is .50 in. or .60 in., and large errors are heavily weighted by least squares. On the other hand, it is probably better to forecast a great number of no-precipitation cases and accept a few light precipitation cases as errors, than to forecast a large number of small amounts and accept

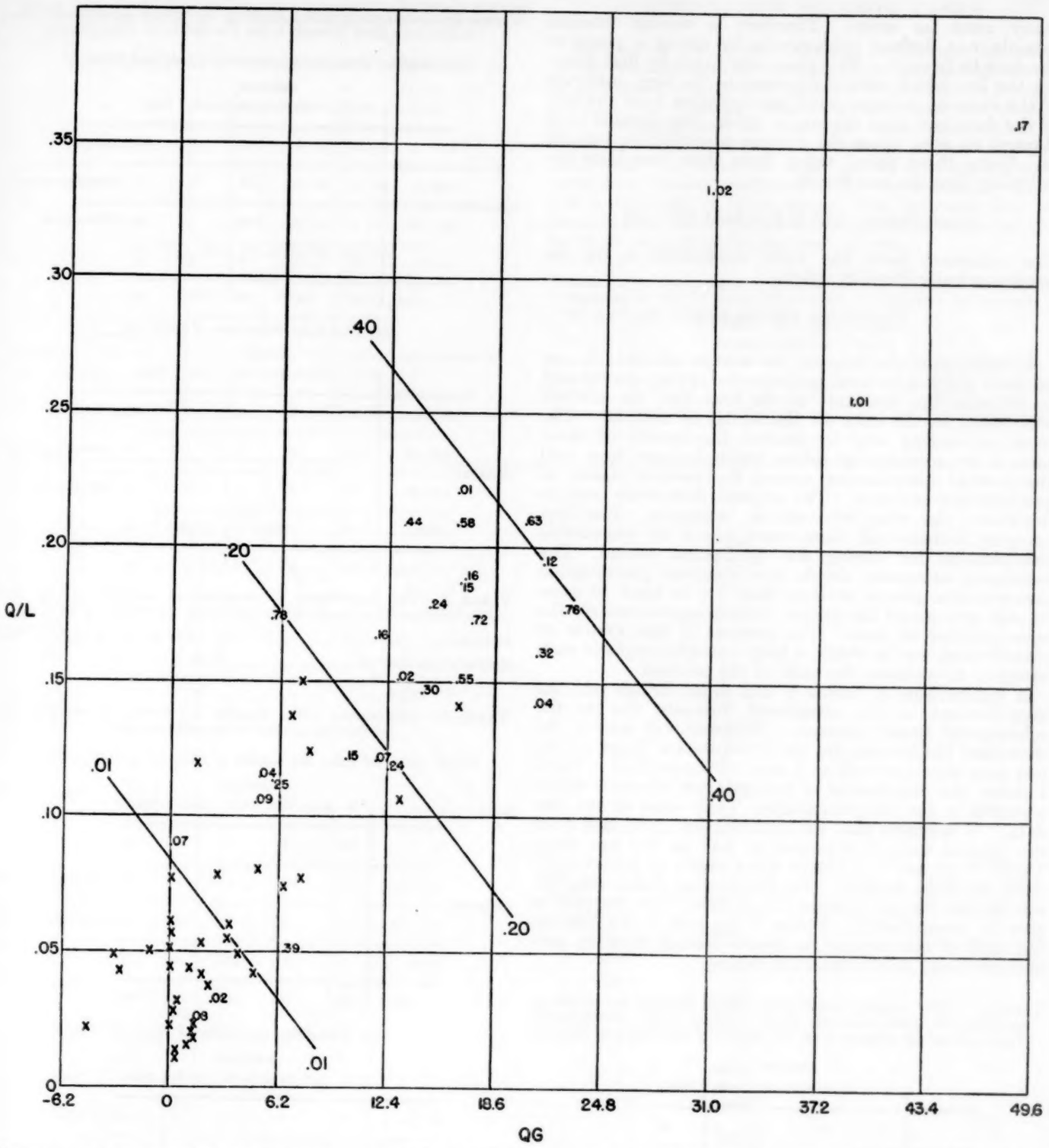

FIGURE 1.—A plot of Q/L against QG with precipitation amounts entered at each point. No measurable precipitation is indicated by a cross. The lines represent the subjectively fitted plane.

many zeros as errors. Therefore a second forecast formula was derived subjectively by fitting a plane to the data in figure 1. This plane was fitted by first drawing the line which seemed to separate the large majority of the cases of no measurable precipitation from the rest of the data and then drawing a .30-in. line parallel to it through an area where the average precipitation was .30 in. Using three points taken from these two lines the following formula was fitted:

$$Precipitation = 1.35\ Q/L + .0111\ QG - .10$$

The constants have the same dimensions as for the mathematically fitted equation.

RESULTS OF TESTS

In addition to the data for the winters of 1943–44 and 1944–45 which were used to derive the typing system and to evaluate the constants in the formulae, the method was tested on the data for the winter of 1945–46. The most convenient way to present the results of these tests is by contingency tables which indicate how well the method discrminates among the various classes of precipitation amounts. The original data were used to determine the class intervals or categories. The first category includes all those cases where no measurable precipitation fell during the verification period. The remaining categories divide the observed precipitation amounts into groups so that there are at least 10 cases in each group and the groups contain approximately the same number of cases. The purpose of this system of classification was to obtain a large enough sample in each category to estimate the skill of the method.

A comparison of tables 1 and 2 (a) brings out the improvement in the categorical forecasts due to the subjectively fitted equation. Tables 2 (a) and 2 (b) show that the formula fits the Precipitation Type on the test data almost as well as it does on the original. Table 3 shows the distribution of precipitation amounts which occurred in the No-precipitation Type cases of the test data. It indicates that the stratification developed from the original data does almost as well on the test data. Tables 4 (a) and 4 (b) show what might be achieved by daily use of the method. For the purpose of this comparison all the No-precipitation Type cases were forecast to give no precipitation. Tables 5 (a) and 5 (b) indicate the skill of the method in discriminating between precipitation and no-precipitation cases.

TABLE 1.—*Four category contingency tables showing the results of applying the mathematically fitted equation to the Precipitation Type cases of the original data: the winters of 1943–44 and 1944–45*

		FORECAST				
		0	0.01–.10	0.11–.30	>0.30	Total
OBSERVED	0	15	15	6	0	36
	0.01–.10	2	1	5	1	9
	0.11–.30	0	0	6	4	10
	>0.30	0	1	4	6	11
	Total	17	17	21	11	66

Percent correct = 42

Skill score = .22

TABLE 2.—*Contingency tables showing the results of applying the subjectively fitted formula to the Precipitation Type cases*

(a) *Original data: the winters of 1943–44 and 1944–45*

		FORECAST				
		0	0.01–.10	0.11–.30	>0.30	Total
OBSERVED	0	22	9	5	0	36
	0.01–.10	2	2	3	2	9
	0.11–.30	0	0	7	3	10
	>0.30	0	1	2	8	11
	Total	24	12	17	13	66

Percent correct = 59

Skill score = .42

(b) *Test data: the winter of 1945–46*

		FORECAST				
		0	0.01–.10	0.11–.30	>0.30	Total
OBSERVED	0	10	3	2	2	17
	0.01–.10	1	4	4	2	11
	0.11–.30	0	0	3	3	6
	>0.30	0	1	0	4	5
	Total	11	8	9	11	39

Percent correct = 54

Skill score = .39

TABLE 3.—*The distribution of precipitation amounts in the No-Precipitation Type cases of the test data: the winter of 1945–46*

Categories	0	0.01–.10	0.11–.30	Total
Number of cases observed	47	1	3	51

Percentage of cases with precipitation = 7.8

TABLE 4.—*Contingency tables showing the results of applying the forecasting method to the entire sample*

(a) *Original data: the winters of 1943–44 and 1944–45*

		FORECAST				
		0	0.01–.10	0.11–.30	>0.30	Total
OBSERVED	0	130	9	5	0	144
	0.01–.10	4	2	3	2	11
	0.11–.30	2	0	7	3	12
	>0.30	0	1	2	8	11
	Total	136	12	17	13	178

Percent correct = 82

Skill score = .52

(b) *Test data: the winter of 1945–46*

		FORECAST				
		0	0.01–.10	0.11–.30	>0.30	Total
OBSERVED	0	57	3	2	2	64
	0.01–.10	2	4	4	2	12
	0.11–.30	3	0	3	3	9
	>0.30	0	1	0	4	5
	Total	62	8	9	11	90

Percent correct = 75

Skill score = .49

TABLE 5.—*Two category contingency tables showing the results of using the forecasting method to discriminate between precipitation and no precipitation*

(*a*) *Original data: the winters of 1943–44 and 1944–45*

		FORECAST: No Precip.	Precip.	Total	
OBSERVED	No Precip.	130	14	144	Percent correct=89
	Precip.	6	28	34	Skill score=.67
	Total	136	42	178	

(*b*) *Test data: the winter of 1945–46*

		FORECAST: No Precip.	Precip.	Total	
OBSERVED	No Precip.	57	7	64	Percent correct=87
	Precip.	5	21	26	Skill score=.68
	Total	62	28	90	

APPLICATION TO SNOW CASES

Because of the great economic importance of heavy snow it is of interest to examine the results of this formula as applied to the cases of snow at Washington. Because snow is less frequent than rain, both samples of data were combined and all the snow cases were collected. When the computed amount of precipitation was correlated with the observed amounts for the twelve snow cases a correlation coefficient of .84 was obtained. Table 6 is a catalogue of these cases. This indicates that the formula does as well forecasting the precipitation amounts for snow as it does the amounts of rain.

TABLE 6.—*A comparison of the observed and computed precipitation amounts for the 12 cases, wherein the precipitation fell as snow in the 3 winters 1943–44, 1944–45, and 1945–46*

	Precipitation amounts (inches)										
Observed	0.16	0.02	0.03	0.01	0.30	0.07	0.29	0.05	0.03	0.01	0.44
Forecast	.25	0	0	0	.26	.02	.11	.08	.06	.04	.33

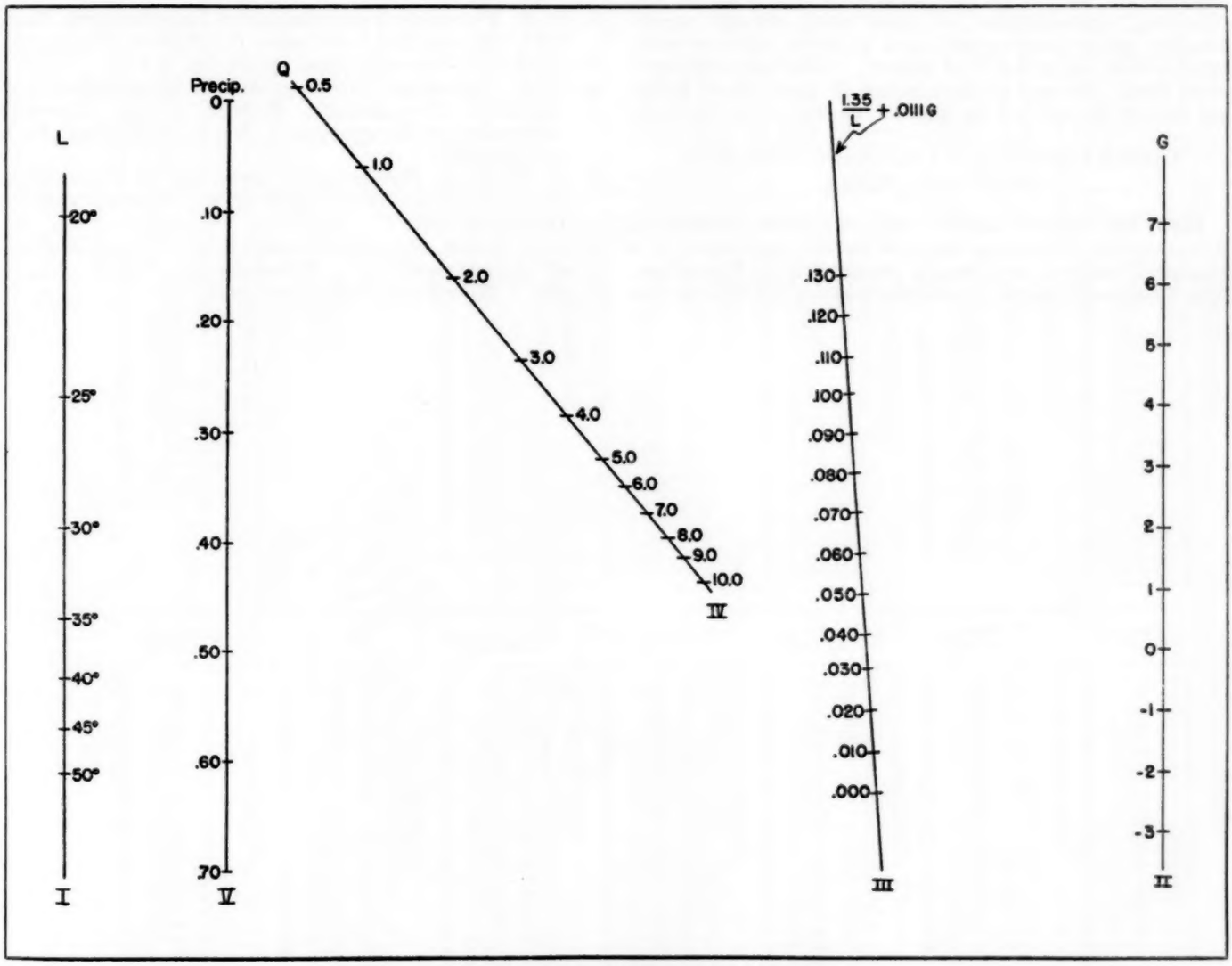

FIGURE 2.—A nomograph designed to give the solution to the equation
Precipitation=1.35 Q/L+.0111 QG−.10

USE OF THE FORMULA

In order to simplify the computations involved in using the formula, a nomograph (fig. 2) was devised which, with two settings of a straightedge, performs all the necessary arithmetic. L and G are first combined by setting a straightedge at the appropriate points on lines I and II. The resultant combination is found on line III. Using this point and the value of Q on line IV the precipitation amount is read from line V.

In general the forecaster should try subjectively to incorporate other factors into the method. If, for example, the low pressure center associated with the rain area is forecast to pass well to the south of Washington, it would indicate that L and G are not giving good indications of the vertical velocity and the forecast could be reduced accordingly. Perhaps the 850-mb. level is very dry but is just above a moist layer; this fact may be used subjectively to increase Q. Subjective changes should always be considered in terms of modifications of the variables in the formula.

A study of some of the large errors indicated that there is some difficulty with those cases wherein the computed amount was very large and little or no precipitation was observed. Investigation of these cases showed unseasonably warm temperatures and pressure patterns more typical of spring or fall than winter. Although only three such cases occurred in three years of data, these atypical factors should not be ignored in making a forecast.

CONCLUSIONS AND SUGGESTIONS FOR FURTHER WORK

From the limited samples used it appears possible to derive useful forecasting methods by the application of a statistical analysis to a simple meteorological hypothesis. The hypothesis makes it possible to assess the role of each of the variables and to use them in the manner suggested by theory. By so doing it is easier for the practicing forecaster to modify each individual case to conform with his subjective analysis of the situation and also to project the method further into the future. It would be desirable to test this formula on more independent samples and at the same time search for additional variables. The patterns of surface pressure systems should contain valuable clues as to the amount of upward motion to be expected, or some measure of the moisture at lower levels might be found useful. Notes collected on the successful subjective changes may give clues to such variables. It is strongly urged that any new or different variables be incorporated into the system with due regard for their physical meaning.

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METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR SEPTEMBER 1949

AEROLOGICAL OBSERVATIONS

[For description of change in Table 1 and charts, see REVIEW, January 1946, p. 6]

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meter, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during September 1949*

STATIONS AND MEAN SURFACE PRESSURES

Standard pressure surface (mb.)	Albany, N. Y. (1,006.7 mb.)				Albuquerque, N. Mex. (839.2 mb.)				Atlanta, Ga. (983.6 mb.)				Big Spring, Tex. (927.7 mb.)				Bismarck, N. Dak. (955.5 mb.)				Boise, Idaho (913.8 mb.)				Brownsville, Tex. (1,011.7 mb)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	86	13.1	86	30	1,620	21.8	44	30	300	20.2	79	30	774	23.4	60	30	505	12.9	57	30	868	20.2	39	30	6	26.6	85
1,000	30	142	(*)	----	30	60	(*)	----	30	157	(*)	----	30	112	(*)	----	30	116	(*)	----	30	77	(*)	----	30	109	26.5	82
950	30	579	13.7	69	30	526	(*)	----	30	601	20.6	70	30	569	(*)	----	30	556	(*)	----	30	532	(*)	----	30	566	23.9	78
900	30	1,030	11.0	69	30	1,006	(*)	----	30	1,067	17.7	72	30	1,039	23.1	58	30	1,010	13.5	46	30	999	22.6	30	30	1,034	21.5	71
850	30	1,505	8.5	67	30	1,509	(*)	----	30	1,555	14.8	71	30	1,536	20.1	59	30	1,488	10.0	50	30	1,494	19.9	28	30	1,529	19.0	63
800	30	2,004	6.4	59	30	2,034	20.0	41	30	2,066	12.7	56	30	2,056	16.6	62	30	1,990	7.2	50	30	2,012	15.9	32	30	2,048	16.1	63
750	30	2,538	4.1	56	30	2,590	16.1	43	30	2,610	10.3	51	30	2,608	13.0	62	30	2,527	4.3	51	30	2,558	11.7	34	30	2,600	13.1	61
700	30	3,090	1.5	53	30	3,169	11.2	49	30	3,177	7.5	47	30	3,181	9.5	56	30	3,077	1.0	49	30	3,128	7.1	38	30	3,172	10.0	53
650	29	3,688	−1.6	49	30	3,785	6.2	53	30	3,789	4.4	39	30	3,798	6.0	49	30	3,676	−2.4	46	30	3,735	2.4	41	30	3,790	6.5	54
600	29	4,318	−5.7	49	30	4,433	1.1	59	30	4,431	.7	34	30	4,444	1.8	47	30	4,301	−5.9	40	30	4,374	−2.4	43	30	4,438	2.6	52
550	29	4,994	−9.9	41	30	5,130	−3.7	59	30	5,124	−3.5	34	30	5,139	−2.5	44	30	4,982	−10.0	39	30	5,060	−7.1	42	30	5,137	−1.2	48
500	29	5,723	−14.8	38	30	5,875	−8.5	58	30	5,871	−8.1	33	29	5,889	−7.4	42	30	5,706	−14.9	38	30	5,795	−11.9	39	30	5,890	−5.6	48
450	29	6,516	−20.2	----	30	6,689	−13.4	42	30	6,688	−13.4	----	29	6,708	−12.4	36	29	6,507	−20.7	----	30	6,602	−17.5	34	28	6,720	−10.8	44
400	28	7,372	−26.6	----	30	7,571	−19.5	----	30	7,568	−19.7	----	29	7,592	−18.3	33	29	7,356	−27.0	----	30	7,465	−23.8	----	28	7,604	−16.6	40
350	28	8,323	−33.0	----	30	8,548	−26.9	----	30	8,544	−26.9	----	29	8,575	−25.2	----	29	8,303	−34.4	----	29	8,424	−31.2	----	28	8,593	−23.4	----
300	28	9,390	−40.3	----	30	9,639	−35.4	----	30	9,637	−35.3	----	26	9,674	−33.5	----	29	9,363	−42.3	----	29	9,498	−39.4	----	27	9,702	−31.8	----
250	27	10,611	−48.1	----	28	10,886	−44.9	----	30	10,881	−44.7	----	25	10,930	−43.0	----	29	10,575	−49.7	----	28	10,724	−48.1	----	25	10,967	−41.5	----
200	27	12,057	−54.4	----	28	12,342	−55.0	----	30	12,337	−55.7	----	23	12,460	−53.7	----	27	12,016	−53.4	----	23	12,165	−53.7	----	23	12,441	−53.5	----
175	24	12,920	−56.8	----	23	13,195	−59.5	----	30	13,175	−61.2	----	20	13,253	−59.1	----	25	12,872	−54.9	----	20	13,021	−56.1	----	20	13,285	−60.1	----
150	20	13,885	−58.2	----	17	14,150	−64.9	----	29	14,118	−65.9	----	15	14,229	−65.2	----	24	13,848	−56.4	----	15	14,000	−57.5	----	17	14,230	−66.7	----
125	18	15,029	−58.7	----	10	15,246	−69.5	----	26	15,212	−69.3	----	9	15,319	−70.9	----	23	15,000	−57.4	----	12	15,135	−58.8	----	11	15,316	−73.0	----
100	17	16,416	−59.4	----					18	16,544	−69.6	----					14	16,393	−58.7	----					6	16,625	−76.2	----
80	9	17,810	−57.4	----					9	17,879	−65.1	----																

	Buffalo, N. Y. (990.7 mb.)				Camaguey, Cuba [1] (mb.)				Caribou, Maine (992.9 mb.)				Charleston, S. C. (1,014.8 mb.)				Ciudad Victoria, Mex. (972.5 mb.)				Columbia, Mo. (989.6 mb.)				Dodge City, Kans. (926.0 mb.)			
Surface	30	221	13.9	77	----	----	----	----	30	191	10.9	87	30	18	21.4	91	27	335	27.6	65	30	239	16.4	72	30	792	17.8	65
1,000	30	141	(*)	----	----	----	----	----	30	130	(*)	----	30	146	22.4	82	27	86	(*)	----	30	146	(*)	----	30	125	(*)	----
950	30	581	13.5	69	----	----	----	----	30	562	11.6	73	30	597	21.2	70	27	546	26.2	64	30	589	17.5	55	30	573	(*)	----
900	30	1,081	10.5	69	----	----	----	----	30	1,011	9.5	70	30	1,060	18.3	68	27	1,017	22.5	67	30	1,045	14.7	55	30	1,037	19.0	58
850	30	1,502	7.7	68	----	----	----	----	30	1,484	7.2	64	30	1,549	15.5	67	27	1,512	18.7	72	30	1,527	12.6	50	30	1,527	17.5	54
800	30	2,000	5.4	58	----	----	----	----	30	1,981	4.9	59	30	2,062	13.0	64	27	2,030	14.7	78	30	2,034	10.9	43	30	2,043	15.4	53
750	30	2,530	3.5	48	----	----	----	----	30	2,510	2.4	58	30	2,606	10.1	59	27	2,583	11.7	75	30	2,576	8.6	43	30	2,592	12.6	50
700	30	3,083	1.0	48	----	----	----	----	30	3,060	−.6	55	30	3,174	7.6	56	27	3,149	8.7	67	30	3,138	5.4	45	30	3,164	8.9	49
650	29	3,680	−2.4	40	----	----	----	----	29	3,651	−3.6	47	30	3,785	4.4	50	26	3,767	5.6	60	30	3,745	2.2	43	30	3,777	5.3	45
600	29	4,306	−5.8	40	----	----	----	----	29	4,276	−6.8	45	30	4,430	.7	48	26	4,410	1.9	60	30	4,382	−1.5	40	30	4,422	.5	43
550	29	4,984	−10.3	38	----	----	----	----	29	4,953	−11.0	44	29	5,124	−3.4	47	23	5,109	−2.0	57	30	5,071	−5.3	33	30	5,116	−4.3	39
500	29	5,709	−15.2	39	----	----	----	----	29	5,676	−15.6	43	28	5,873	−7.8	38	21	5,860	−6.1	50	30	5,812	−9.9	32	30	5,859	−8.9	34
450	28	6,504	−20.4	----	----	----	----	----	29	6,468	−21.0	----	28	6,691	−12.9	----	21	6,685	−11.1	43	30	6,625	−15.5	----	30	6,673	−14.4	----
400	27	7,357	−26.7	----	----	----	----	----	29	7,323	−27.3	----	28	7,575	−18.7	----	21	7,572	−16.8	39	30	7,495	−22.0	----	30	7,549	−21.2	----
350	25	8,311	−33.6	----	----	----	----	----	28	8,280	−33.5	----	28	8,556	−25.5	----	20	8,562	−23.6	----	29	8,462	−29.4	----	30	8,520	−28.5	----
300	17	9,395	−40.9	----	----	----	----	----	28	9,345	−40.7	----	28	9,656	−33.6	----	20	9,669	−31.9	----	28	9,542	−37.8	----	30	9,605	−36.9	----
250	13	10,593	−48.6	----	----	----	----	----	27	10,564	−47.8	----	28	10,909	−43.2	----	19	10,931	−42.1	----	28	10,773	−46.8	----	30	10,841	−46.3	----
200	5	12,054	−55.4	----	----	----	----	----	24	12,033	−52.6	----	28	12,373	−54.6	----	16	12,392	−54.9	----	27	12,224	−55.6	----	30	12,290	−55.9	----
175	----	----	----	----	----	----	----	----	23	12,898	−54.1	----	26	13,218	−60.2	----	13	13,228	−61.9	----	25	13,067	−59.3	----	29	13,129	−59.9	----
150	----	----	----	----	----	----	----	----	22	13,893	−55.3	----	24	14,167	−65.2	----	12	14,167	−68.7	----	25	14,025	−62.3	----	29	14,082	−63.6	----
125	----	----	----	----	----	----	----	----	16	15,070	−57.0	----	21	15,267	−68.2	----	10	15,247	−75.0	----	22	15,141	−64.2	----	26	15,188	−66.8	----
100	----	----	----	----	----	----	----	----	13	16,492	−57.2	----	16	16,601	−70.1	----	8	16,518	−77.9	----	12	16,477	−64.8	----	21	16,526	−67.3	----
80	----	----	----	----	----	----	----	----					8	17,954	−67.2	----	6	17,792	−73.3	----					13	17,855	−63.9	----
60	----	----	----	----	----	----	----	----																	7	19,658	−59.0	----

	El Paso, Tex. (881.7 mb.)				Ely, Nev. (809.3 mb.)				Glasgow, Mont. (939.3 mb.)				Grand Junction, Colo. (852.4 mb.)				Great Falls, Mont. (888.2 mb.)				Greensboro, N. C. (986.8 mb.)				Hatteras, N. C. (1,017.1 mb.)			
Surface	30	1,195	24.5	52	30	1,908	16.1	30	30	648	14.6	43	30	1,474	20.7	36	30	1,128	15.7	43	30	273	17.6	88	30	3	22.8	82
1,000	30	72	(*)	----	30	55	(*)	----	30	110	(*)	----	30	63	(*)	----	30	104	(*)	----	30	158	(*)	----	30	152	22.1	80
950	30	536	(*)	----	30	514	(*)	----	30	553	(*)	----	30	524	(*)	----	30	557	(*)	----	30	601	18.7	71	30	599	19.4	77
900	30	1,019	(*)	----	30	986	(*)	----	30	1,011	16.0	35	30	1,003	(*)	----	30	1,024	(*)	----	30	1,062	15.9	72	30	1,060	16.6	75
850	30	1,517	23.5	48	30	1,482	(*)	----	30	1,493	12.3	38	30	1,499	(*)	----	30	1,501	14.6	39	30	1,546	13.1	69	30	1,545	13.7	73
800	30	2,043	19.4	52	30	2,007	19.7	25	30	1,998	8.6	42	30	2,025	20.6	30	30	2,009	10.8	42	30	2,054	10.6	62	30	2,054	11.4	60
750	30	2,600	15.2	56	30	2,561	16.4	26	30	2,529	4.9	46	30	2,580	16.1	33	30	2,547	6.7	46	30	2,596	8.4	53	30	2,595	9.0	52
700	30	3,175	10.7	61	30	3,140	11.3	29	30	3,087	1.5	45	30	3,159	11.3	38	30	3,106	2.8	49	30	3,158	5.8	43	30	3,161	6.5	46
650	30	3,794	6.3	59	30	3,752	5.9	35	30	3,682	−2.1	41	30	3,776	6.1	43	30	3,705	−1.1	48	30	3,765	2.3	45	29	3,769	3.3	46
600	30	4,440	1.9	56	30	4,401	.1	41	30	4,311	−6.2	43	30	4,422	.7	49	30	4,336	−5.4	50	30	4,403	−1.1	42	28	4,410	−.4	48
550	30	5,140	−2.9	52	30	5,089	−5.7	48	30	4,991	−10.4	38	30	5,116	−4.5	50	30	5,018	−9.5	42	30	5,096	−5.1	38	27	5,102	−4.4	47
500	30	5,885	−7.4	48	30	5,831	−10.7	35	29	5,711	−15.5	34	30	5,858	−9.7	50	30	5,743	−14.7	42	30	5,835	−9.5	35	26	5,846	−8.7	41
450	29	6,709	−12.6	45	30	6,638	−16.1	----	28	6,496	−21.5	----	30	6,675	−15.0	41	30	6,540	−20.6	----	30	6,650	−14.8	33	25	6,661	−13.8	----
400	29	7,589	−18.7	40	30	7,510	−22.8	----	28	7,350	−27.8	----	30	7,544	−21.3	----	30	7,392	−27.3	----	30	7,524	−21.0	----	25	7,539	−20.0	----
350	29	8,571	−25.6	----	30	8,476	−30.1	----	28	8,295	−34.9	----	30	8,514	−28.9	----	30	8,338	−34.8	----	30	8,495	−28.2	----	24	8,512	−26.7	----
300	27	9,670	−33.8	----	30	9,554	−37.0	----	28	9,352	−42.8	----	30	9,597	−37.2	----	29	9,388	−43.1	----	30	9,583	−36.1	----	23	9,610	−35.0	----
250	27	10,922	−43.5	----	30	10,785	−46.8	----	28	10,561	−49.9	----	30	10,831	−46.5	----	29	10,595	−50.4	----	30	10,823	−45.1	----	23	10,855	−44.5	----
200	24	12,394	−54.4	----	28	12,238	−54.4	----	23	11,990	−53.3	----	27	12,276	−55.2	----	25	12,029	−55.0	----	29	12,287	−55.1	----	22	12,310	−55.5	----
175	22	13,236	−60.5	----	28	13,085	−58.1	----	21	12,857	−54.5	----	23	13,122	−58.0	----	22	12,890	−56.1	----	28	13,125	−59.8	----	21	13,150	−60.9	----
150	18	14,175	−67.0	----	27	14,049	−60.9	----	14	13,840	−55.9	----	21	14,086	−61.0	----	18	13,855	−57.7	----	22	14,093	−63.8	----	19	14,102	−65.5	----
125	13	15,267	−72.7	----	20	15,179	−63.8	----	9	15,019	−58.3	----	17	15,214	−63.5	----	14	15,000	−58.0	----	17	15,192	−66.4	----	12	15,223	−68.1	----
100	5	16,543	−74.5	----	17	16,535	−65.5	----	7	16,399	−58.3	----	7	16,592	−67.4	----	8	16,398	−58.3	----	10	16,548	−66.1	----	7	16,584	−68.6	----
80	----	----	----	----	13	17,914	−64.0	----	----	----	----	----	----	----	----	----	----	----	----	----	8	17,905	−62.6	----	----	----	----	----
60	----	----	----	----	7	19,687	−60.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meter, temperature in degrees centigrade, and relative humidity in percent, for standard pressures, as obtained by radiosondes during September 1949*—Continued

Standard pressure surface (mb.)	Havana, Cuba [1] (.... mb.)				Honolulu, T. H. (1,014.4 mb.)				International Falls, Minn. (970.2 mb.)				Joliet, Ill. (996.0 mb.)				Lake Charles, La. (1,014.1 mb.)				Lander, Wyo. (830.9 mb.)				Las Vegas, Nev. (932.8 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	....	.....	.....	....	30	3	27.2	58	30	360	9.3	84	29	178	13.4	76	30	5	23.8	85	30	1,696	14.8	44	30	660	28.7	16
1,000	....	.....	.....	....	30	129	25.3	61	30	106	(*)	....	29	143	(*)	....	30	128	25.1	77	30	90	(*)	....	30	32	(*)	....
950	....	.....	.....	....	30	580	21.4	68	30	537	11.4	72	29	583	15.2	58	30	581	23.2	73	30	543	(*)	....	30	497	(*)	....
900	....	.....	.....	....	30	1,045	17.6	73	30	986	9.8	64	29	1,035	12.3	57	30	1,050	20.3	73	30	1,015	(*)	....	30	981	31.0	16
850	....	.....	.....	....	30	1,532	14.9	69	30	1,459	6.6	65	29	1,512	9.4	54	30	1,542	17.3	73	30	1,501	(*)	....	30	1,488	26.8	17
800	....	.....	.....	....	30	2,043	12.7	57	30	1,954	3.7	67	29	2,013	7.3	51	30	2,058	14.7	69	30	2,018	15.5	38	30	2,018	21.9	20
750	....	.....	.....	....	30	2,593	13.0	24	30	2,482	.7	62	29	2,548	4.9	46	30	2,608	12.1	63	30	2,567	11.5	41	30	2,573	16.8	25
700	....	.....	.....	....	30	3,163	11.0	....	30	3,027	−1.9	55	29	3,103	2.3	40	30	3,178	9.2	54	30	3,135	7.7	42	30	3,154	11.5	29
650	....	.....	.....	....	28	3,780	7.6	....	30	3,621	−4.8	52	29	3,701	−1.0	39	30	3,793	5.7	48	30	3,746	3.5	43	30	3,771	6.6	31
600	....	.....	.....	....	27	4,431	3.9	....	30	4,239	−8.5	49	29	4,333	−4.6	36	30	4,440	1.8	48	30	4,385	−1.6	47	30	4,419	1.7	28
550	....	.....	.....	....	27	5,134	−.5	....	30	4,913	−12.2	41	29	5,014	−8.5	....	29	5,138	−2.2	45	30	5,073	−6.7	47	30	5,113	−3.3	....
500	....	.....	.....	....	27	5,887	−5.3	....	30	5,632	−16.8	35	29	5,746	−13.3	....	29	5,887	−6.6	37	30	5,809	−11.7	43	30	5,860	−8.5	....
450	....	.....	.....	....	26	6,711	−11.2	....	30	6,423	−22.2	....	29	6,546	−18.7	....	28	6,712	−12.0	....	30	6,616	−17.2	38	29	6,680	−14.0	....
400	....	.....	.....	....	25	7,598	−17.7	....	29	7,273	−28.5	....	29	7,407	−25.2	....	28	7,594	−18.4	....	30	7,480	−23.9	....	29	7,557	−20.1	....
350	....	.....	.....	....	24	8,582	−24.9	....	29	8,216	−35.4	....	28	8,362	−32.7	....	27	8,576	−25.3	....	29	8,440	−31.3	....	28	8,534	−27.4	....
300	....	.....	.....	....	24	9,683	−33.5	....	29	9,276	−42.6	....	28	9,431	−40.4	....	27	9,675	−34.0	....	29	9,513	−39.8	....	27	9,621	−36.0	....
250	....	.....	.....	....	23	10,937	−43.5	....	28	10,487	−49.0	....	28	10,653	−47.9	....	27	10,924	−44.0	....	29	10,734	−48.9	....	26	10,861	−44.6	....
200	....	.....	.....	....	22	12,397	−55.3	....	24	11,945	−52.8	....	27	12,103	−55.0	....	27	12,384	−55.3	....	29	12,174	−55.9	....	25	12,324	−53.4	....
175	....	.....	.....	....	22	13,237	−61.4	....	23	12,799	−53.3	....	26	12,948	−57.2	....	27	13,223	−61.3	....	28	13,016	−57.6	....	23	13,172	−57.8	....
150	....	.....	.....	....	21	14,182	−66.8	....	23	13,789	−54.2	....	24	13,912	−59.4	....	26	14,163	−67.3	....	27	13,987	−59.6	....	20	14,134	−62.3	....
125	....	.....	.....	....	19	15,273	−70.3	....	21	14,953	−55.4	....	22	15,053	−61.0	....	23	15,247	−71.8	....	25	15,115	−61.2	....	18	15,241	−66.4	....
100	....	.....	.....	....	16	16,598	−71.0	....	11	16,372	−56.8	....	19	16,427	−61.2	....	18	16,556	−74.4	....	22	16,495	−62.7	....	13	16,583	−68.5	....
80	....	.....	.....	....	12	17,920	−68.0	....	.....	.....	.....	....	16	17,814	−59.4	....	10	17,858	−69.3	....	12	17,882	−61.2	....	8	17,937	−66.1	....

Standard pressure surface (mb.)	Little Rock, Ark. (1,007.5 mb.)				Mazatlan, Mex. (1,006.5 mb.)				Medford, Oreg. (966.8 mb.)				Merida, Mex. (1,009.0 mb.)				Miami, Fla. (1,015.0 mb.)				Nantucket, Mass. (1,015.7 mb.)				Nashville, Tenn. (997.1 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	79	19.6	80	30	14	28.8	78	30	401	20.3	52	30	27	26.6	82	30	4	26.5	83	30	14	15.9	86	30	177	19.1	72
1,000	30	143	21.4	70	30	72	28.3	78	30	106	(*)	....	30	107	26.2	81	30	136	26.3	79	30	148	16.7	79	30	152	(*)	....
950	30	592	21.1	61	30	534	25.1	80	30	560	21.7	46	30	560	24.3	78	30	590	23.6	78	30	592	15.2	66	30	595	18.8	61
900	30	1,056	18.0	66	30	1,003	23.0	76	30	1,019	18.7	48	30	1,033	21.5	79	30	1,059	20.9	76	30	1,041	13.1	60	30	1,056	15.7	63
850	30	1,543	15.3	62	30	1,500	20.3	73	30	1,506	15.2	50	30	1,527	18.4	79	30	1,552	18.0	73	30	1,520	10.9	56	30	1,540	13.1	60
800	30	2,056	13.8	50	30	2,023	17.5	70	30	2,017	11.9	52	30	2,046	15.2	77	30	2,070	15.1	70	30	2,023	8.7	51	30	2,048	11.0	49
750	30	2,602	11.3	48	30	2,582	14.7	67	30	2,557	8.6	49	30	2,596	12.3	74	30	2,617	12.2	64	30	2,560	6.1	52	30	2,589	8.8	41
700	30	3,171	8.3	42	30	3,154	10.9	68	30	3,121	5.5	39	30	3,168	9.5	69	30	3,190	9.0	58	30	3,117	3.0	50	30	3,153	6.1	39
650	30	3,785	4.6	43	29	3,776	7.1	71	30	3,727	1.5	36	30	3,784	6.1	64	30	3,804	5.8	52	30	3,717	0.0	39	30	3,762	2.9	40
600	29	4,428	.9	40	29	4,424	3.0	69	29	4,365	−2.3	36	30	4,433	2.3	62	29	4,453	2.1	45	30	4,350	−3.9	40	30	4,401	−.6	37
550	29	5,123	−2.6	40	29	5,127	−1.2	67	29	5,050	−6.6	33	30	5,130	−1.7	57	29	5,153	−2.0	44	30	5,035	−7.8	36	30	5,093	−4.3	30
500	29	5,873	−7.2	38	29	5,880	−5.3	65	29	5,787	−11.6	....	29	5,885	−6.0	54	29	5,902	−6.3	44	30	5,767	−12.6	34	30	5,836	−9.3	29
450	29	6,692	−12.9	36	28	6,714	−10.1	56	29	6,591	−17.1	....	28	6,710	−10.7	49	29	6,732	−11.2	41	30	6,572	−18.0	35	30	6,649	−15.1	....
400	29	7,574	−19.3	37	28	7,601	−15.8	49	28	7,460	−23.9	....	27	7,598	−16.6	46	29	7,613	−17.0	41	30	7,433	−23.7	....	30	7,523	−21.2	....
350	29	8,552	−26.5	....	28	8,594	−22.4	....	27	8,418	−31.6	....	27	8,587	−23.8	....	29	8,601	−23.7	....	30	8,392	−29.9	....	30	8,494	−28.5	....
300	29	9,647	−34.7	....	28	9,708	−30.8	....	26	9,493	−39.8	....	27	9,693	−32.3	....	29	9,708	−32.0	....	29	9,473	−37.2	....	30	9,580	−36.6	....
250	29	10,895	−43.9	....	24	10,976	−40.8	....	23	10,717	−48.1	....	26	10,951	−42.7	....	29	10,966	−42.2	....	29	10,711	−45.6	....	30	10,818	−45.8	....
200	28	12,359	−54.0	....	24	12,458	−53.2	....	22	12,165	−54.4	....	25	12,412	−55.5	....	29	12,437	−54.5	....	24	12,160	−54.7	....	28	12,264	−55.4	....
175	27	13,204	−59.1	....	23	13,303	−60.3	....	16	13,025	−56.8	....	25	13,249	−62.8	....	27	13,277	−61.0	....	24	13,007	−57.9	....	28	13,106	−59.7	....
150	25	14,156	−63.6	....	21	14,250	−67.9	....	13	14,019	−60.2	....	22	14,178	−70.2	....	27	14,219	−67.6	....	18	13,959	−61.1	....	23	14,060	−63.4	....
125	22	15,253	−67.4	....	18	15,324	−75.0	....	10	15,145	−62.2	....	15	15,242	−75.6	....	21	15,308	−72.1	....	15	15,093	−62.3	....	17	15,179	−67.3	....
100	13	16,597	−68.8	....	15	16,601	−78.8	....	.....	.....	.....	....	5	16,537	−75.5	....	10	16,626	−72.5	....	7	16,401	−60.2	....	13	16,496	−66.2	....
80	6	17,942	−65.8	....	6	17,891	−71.8	....	.....	.....	.....	....	.....	.....	.....	....	.....	.....	.....	....	.....	.....	.....	....	6	17,877	−64.2	....

Standard pressure surface (mb.)	New Orleans, La. (1,014.8 mb.)				North Platte, Nebr. (918.4 mb.)				Oakland, Calif. (1,011.8 mb.)				Oklahoma City, Okla. (970.6 mb.)				Omaha, Nebr. (981.0 mb.)				Phoenix, Ariz. (968.9 mb.)				Pittsburgh, Pa. (973.6 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	29	2	24.4	85	30	849	15.0	65	30	6	17.5	74	30	391	19.6	73	30	308	16.3	73	30	339	30.4	42	30	382	14.8	73
1,000	29	131	24.6	80	30	116	(*)	....	30	106	17.2	71	30	131	(*)	....	30	143	(*)	....	30	54	(*)	....	30	153	(*)	....
950	29	585	22.5	77	30	562	(*)	....	30	554	18.8	60	30	580	20.9	63	30	585	16.2	55	30	518	32.8	34	30	595	15.1	67
900	29	1,051	19.7	75	30	1,022	17.8	52	30	1,011	19.6	41	29	1,044	19.0	60	30	1,039	13.6	55	30	1,001	29.5	35	30	1,046	12.5	67
850	29	1,542	16.9	73	30	1,509	15.7	50	30	1,502	17.9	34	29	1,533	17.1	57	30	1,519	11.3	52	30	1,507	25.5	39	30	1,524	9.6	66
800	29	2,058	14.4	66	30	2,021	12.8	50	30	2,017	14.9	31	29	2,048	14.2	61	30	2,024	10.0	44	30	2,035	21.1	43	30	2,025	7.3	56
750	29	2,604	11.8	59	30	2,568	9.9	49	30	2,563	11.6	27	29	2,595	11.7	53	30	2,565	7.7	42	30	2,593	16.5	48	30	2,563	5.5	48
700	29	3,177	9.1	51	30	3,132	6.7	42	30	3,132	8.2	28	29	3,165	8.7	47	30	3,125	4.8	39	30	3,172	11.7	49	30	3,117	2.9	47
650	29	3,791	5.7	48	30	3,737	2.9	34	30	3,744	4.6	....	29	3,778	4.8	43	30	3,730	1.5	37	29	3,790	7.0	50	30	3,722	−.6	43
600	29	4,438	2.2	45	30	4,379	−1.3	31	29	4,388	.2	....	29	4,423	.6	37	30	4,366	−2.5	35	29	4,439	2.3	48	30	4,348	−4.1	38
550	27	5,136	−1.9	41	30	5,068	−6.2	32	29	5,081	−4.5	....	29	5,114	−3.6	35	30	5,052	−7.0	30	29	5,135	−2.8	45	30	5,032	−8.0	37
500	25	5,887	−6.4	41	30	5,804	−11.7	34	28	5,823	−9.7	....	29	5,862	−8.4	35	30	5,787	−11.8	26	29	5,886	−7.5	37	30	5,763	−12.8	35
450	25	6,713	−11.4	....	30	6,610	−17.3	31	28	6,634	−15.7	....	29	6,684	−13.6	32	30	6,591	−17.6	26	28	6,708	−12.6	33	30	6,567	−17.9	35
400	25	7,601	−17.5	....	30	7,475	−23.7	....	28	7,505	−22.6	....	28	7,559	−20.0	....	30	7,457	−24.2	....	28	7,588	−19.0	....	30	7,429	−24.2	....
350	25	8,582	−24.5	....	30	8,435	−31.0	....	28	8,471	−29.9	....	28	8,534	−27.5	....	30	8,416	−31.5	....	28	8,568	−26.0	....	25	8,413	−30.8	....
300	24	9,686	−32.8	....	29	9,512	−39.4	....	27	9,553	−37.5	....	27	9,623	−36.0	....	29	9,489	−39.5	....	27	9,665	−34.4	....	21	9,489	−39.4	....
250	23	10,943	−42.8	....	29	10,735	−48.2	....	26	10,792	−45.4	....	27	10,863	−45.5	....	29	10,714	−48.2	....	26	10,912	−43.7	....	17	10,744	−47.4	....
200	22	12,409	−54.2	....	28	12,178	−56.3	....	24	12,256	−52.8	....	27	12,316	−55.5	....	29	12,157	−56.2	....	25	12,378	−53.9	....	13	12,186	−55.4	....
175	21	13,255	−60.4	....	27	13,019	−59.3	....	20	13,120	−56.9	....	26	13,161	−60.3	....	28	12,998	−58.4	....	24	13,220	−59.4	....	10	13,013	−57.7	....
150	19	14,201	−65.9	....	26	13,980	−61.7	....	13	14,090	−61.0	....	25	14,111	−64.6	....	28	13,961	−60.6	....	21	14,166	−64.7	....	8	13,986	−59.9	....
125	15	15,304	−69.9	....	22	15,101	−64.5	....	7	15,215	−64.5	....	19	15,197	−68.4	....	25	15,088	−62.8	....	15	15,261	−69.0	....	5	15,105	−60.6	....
100	6	16,652	−71.0	....	20	16,466	−65.7	....	5	16,600	−68.2	....	10	16,539	−69.4	....	23	16,456	−63.4	....	12	16,585	−70.3	....	.....	.....	.....	....
80	.....	.....	.....	....	10	17,821	−63.8	....	.....	.....	.....	....	.....	.....	.....	....	21	17,837	−60.8	....	8	17,910	−66.7	....	.....	.....	.....	....
60	.....	.....	.....	....	5	19,602	−58.0	....	.....	.....	.....	....	.....	.....	.....	....	5	19,666	−58.7	....	.....	.....	.....	....	.....	.....	.....	....

See footnotes at end of table.

TABLE 1.—*Mean dynamic height (geopotential) in units of 0.98 dynamic meter, temperature in degrees centigrade, and relative humidity in per cent, for standard pressures, as obtained by radiosondes during September 1949*—Continued

Standard pressure surface (mb.)	Portland, Maine (1,014.3 mb.)				Rapid City, S. Dak. (904.1 mb.)				St. Cloud, Minn. (977.4 mb.)				San Antonio, Tex. (986.3 mb.)				San Juan, P. R. (1,012.9 mb.)				Santa Maria, Calif. (1,003.8 mb.)				Sault Ste. Marie, Mich. (987.7 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	20	12.6	90	30	980	13.4	53	30	317	11.9	74	30	240	25.6	66	30	15	26.1	84	30	71	15.2	87	30	221	10.4	84
1,000	30	139	14.6	80	30	113	(*)	----	30	123	(*)	----	30	117	(*)	----	30	128	25.8	82	30	103	15.0	86	30	117	(*)	----
950	30	577	13.5	69	30	557	(*)	----	30	558	13.9	56	30	577	25.7	61	30	582	23.0	81	30	550	19.5	59	30	551	11.0	72
900	30	1,027	11.0	68	30	1,019	(*)	----	30	1,010	11.3	56	30	1,046	22.4	66	30	1,050	20.2	78	30	1,009	21.8	34	30	996	8.4	70
850	30	1,502	8.6	63	30	1,504	14.9	43	30	1,485	8.2	58	30	1,542	19.1	70	30	1,542	17.4	75	30	1,502	19.8	28	30	1,466	5.3	72
800	30	2,002	6.7	56	30	2,014	11.6	46	30	1,983	5.6	57	30	2,061	15.5	74	30	2,059	14.8	68	30	2,021	16.9	25	30	1,959	2.6	70
750	30	2,535	4.0	54	30	2,554	8.5	48	30	2,514	3.2	49	30	2,609	12.4	68	30	2,610	12.1	62	30	2,574	13.4	25	30	2,485	−.1	62
700	30	3,088	1.1	54	30	3,118	5.3	46	30	3,066	.2	46	30	3,183	9.8	54	30	3,180	8.8	59	30	3,144	9.7	26	30	3,029	−2.6	54
650	30	3,685	−2.0	50	30	3,722	1.5	45	30	3,662	−2.5	42	30	3,790	6.2	49	30	3,790	5.1	55	28	3,757	5.5	----	30	3,618	−5.6	52
600	29	4,319	−5.3	48	30	4,360	−2.7	45	29	4,291	−5.9	40	29	4,448	2.5	48	28	4,440	1.2	53	28	4,402	1.4	----	30	4,238	−8.9	45
550	28	5,009	−9.1	45	30	5,043	−7.4	46	29	4,970	−9.8	36	29	5,150	−1.6	45	28	5,133	−2.7	49	28	5,098	−3.1	----	30	4,908	−13.1	47
500	27	5,734	−13.9	45	30	5,779	−12.6	43	29	5,698	−14.2	34	29	5,900	−6.2	41	27	5,885	−7.4	47	28	5,844	−8.0	----	29	5,624	−18.2	45
450	27	6,539	−19.5	45	30	6,581	−18.0	37	29	6,493	−19.6	37	29	6,728	−11.4	37	27	6,709	−12.5	39	27	6,666	−13.6	----	29	6,414	−23.6	----
400	27	7,392	−25.6	----	30	7,446	−24.2	----	29	7,354	−25.9	----	28	7,610	−17.2	36	27	7,589	−18.5	35	27	7,540	−20.2	----	29	7,255	−29.7	----
350	27	8,346	−32.8	----	30	8,405	−31.6	----	29	8,307	−32.9	----	27	8,597	−24.2	----	27	8,571	−25.7	----	27	8,515	−27.0	----	29	8,193	−36.5	----
300	26	9,430	−39.8	----	29	9,477	−39.6	----	29	9,374	−40.6	----	27	9,702	−32.5	----	27	9,669	−34.2	----	26	9,613	−34.9	----	27	9,249	−43.8	----
250	24	10,660	−48.0	----	28	10,702	−48.3	----	29	10,592	−48.9	----	26	10,959	−42.2	----	27	10,920	−44.2	----	25	10,860	−43.2	----	27	10,454	−50.4	----
200	22	12,100	−56.0	----	23	12,148	−53.8	----	28	12,035	−54.2	----	24	12,429	−53.1	----	27	12,377	−56.1	----	24	12,331	−52.4	----	27	11,902	−52.6	----
175	19	12,958	−58.5	----	18	13,005	−56.1	----	28	12,890	−54.8	----	24	13,278	−59.0	----	25	13,216	−62.4	----	23	13,184	−56.9	----	24	12,764	−53.0	----
150	16	13,925	−60.3	----	13	13,984	−58.1	----	26	13,871	−55.7	----	20	14,231	−65.0	----	25	14,153	−68.2	----	22	14,149	−61.6	----	21	13,745	−53.8	----
125	8	15,080	−61.1	----	11	15,122	−60.6	----	23	15,023	−56.6	----	18	15,322	−70.5	----	19	15,240	−74.4	----	16	15,260	−65.4	----	17	14,905	−54.8	----
100	----	----	----	----	----	----	----	----	14	16,429	−57.0	----	11	16,629	−73.3	----	16	16,530	−74.4	----	12	16,603	−68.2	----	9	16,321	−55.8	----
80	----	----	----	----	----	----	----	----	5	17,852	−55.9	----	5	17,923	−69.2	----	7	17,854	−70.6	----	----	----	----	----	----	----	----	----

Standard pressure surface (mb.)	Spokane, Wash. (931.8 mb.)				Swan Island, W. I. (1,010.9 mb.)				Tacubaya, Mexico (773.8 mb.)				Tampa, Fla. (1,015.2 mb.)				Tatoosh Island, Wash. (1,012.0 mb.)				Toledo, Ohio (994.6 mb.)				Washington, D. C. (1,015.5 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	30	721	17.8	45	29	10	27.0	83	29	2,306	16.1	74	30	9	24.8	88	30	31	12.4	89	30	191	13.2	82	30	25	18.6	74
1,000	30	108	(*)	----	29	106	26.4	83	29	60	(*)	----	30	142	24.9	82	30	131	13.3	82	30	144	(*)	----	30	157	18.5	70
950	30	556	(*)	----	29	560	23.6	82	29	520	(*)	----	30	593	22.9	77	30	570	15.4	62	30	582	14.2	59	30	602	16.5	68
900	30	1,018	18.0	39	29	1,030	21.3	76	29	996	(*)	----	30	1,063	20.3	74	30	1,022	13.8	55	30	1,034	11.2	60	30	1,056	13.8	68
850	30	1,504	14.6	41	29	1,524	18.7	70	29	1,493	(*)	----	30	1,555	17.2	73	30	1,502	11.2	52	30	1,509	8.7	54	30	1,536	11.3	66
800	30	2,013	10.9	41	29	2,043	15.9	66	29	2,019	(*)	----	30	2,071	14.2	71	30	2,005	8.4	53	30	2,008	6.4	49	30	2,041	8.8	63
750	30	2,552	7.2	43	29	2,594	12.8	65	29	2,571	14.3	73	30	2,616	11.1	68	30	2,539	5.7	49	30	2,542	3.9	47	30	2,580	6.4	56
700	30	3,112	3.4	46	29	3,167	9.6	60	29	3,150	10.2	78	29	3,187	8.4	59	30	3,097	2.4	42	30	3,100	1.2	46	30	3,137	3.7	49
650	30	3,711	−.6	47	29	3,783	6.0	57	29	3,768	5.9	82	29	3,800	5.2	53	30	3,692	−1.1	37	30	3,690	−2.1	44	30	3,743	.5	45
600	30	4,343	−4.7	48	29	4,431	2.3	58	29	4,417	2.0	83	29	4,446	1.5	51	30	4,326	−4.9	31	30	4,318	−5.5	42	30	4,374	−3.2	43
550	30	5,022	−9.1	47	29	5,131	−1.9	57	29	5,117	−1.9	81	29	5,143	−2.2	45	30	5,004	−9.0	36	29	4,996	−9.7	39	30	5,061	−6.9	38
500	30	5,754	−13.9	43	29	5,881	−6.6	54	29	5,869	−5.9	72	29	5,894	−6.7	47	30	5,737	−13.8	33	29	5,722	−14.6	37	30	5,795	−11.4	33
450	30	6,554	−19.7	40	28	6,705	−11.6	50	28	6,698	−10.4	58	29	6,717	−11.8	43	30	6,530	−19.2	----	29	6,518	−20.0	34	30	6,602	−16.9	29
400	30	7,410	−26.2	----	27	7,591	−17.3	49	28	7,586	−16.2	54	28	7,604	−17.4	44	30	7,395	−25.4	----	29	7,377	−26.2	----	30	7,469	−23.0	----
350	29	8,363	−33.7	----	26	8,578	−23.8	----	28	8,577	−23.3	----	28	8,589	−24.7	----	30	8,350	−32.2	----	27	8,318	−33.8	----	30	8,434	−30.0	----
300	28	9,436	−41.4	----	26	9,684	−32.1	----	28	9,687	−31.7	----	27	9,691	−33.2	----	28	9,428	−40.0	----	27	9,381	−41.0	----	29	9,510	−37.4	----
250	25	10,656	−49.6	----	26	10,945	−42.0	----	28	10,949	−42.0	----	24	10,947	−43.5	----	28	10,650	−48.0	----	27	10,600	−48.4	----	29	10,746	−45.7	----
200	24	12,099	−54.1	----	24	12,416	−54.1	----	25	12,421	−54.7	----	19	12,409	−55.7	----	24	12,097	−53.6	----	26	12,054	−55.2	----	29	12,200	−55.1	----
175	23	12,953	−56.0	----	24	13,259	−60.7	----	24	13,261	−61.8	----	15	13,254	−62.8	----	22	12,936	−55.1	----	24	12,888	−56.7	----	29	13,044	−58.9	----
150	21	13,925	−56.7	----	24	14,202	−67.4	----	23	14,199	−69.0	----	14	14,190	−69.4	----	16	13,892	−56.8	----	18	13,867	−59.0	----	28	14,007	−61.7	----
125	15	15,070	−57.5	----	22	15,287	−73.8	----	17	15,273	−75.4	----	13	15,258	−74.0	----	12	15,007	−57.2	----	15	15,002	−60.0	----	24	15,129	−63.6	----
100	8	16,481	−59.6	----	18	16,575	−75.9	----	10	16,563	−76.4	----	10	16,575	−72.4	----	6	16,401	−56.8	----	8	16,381	−60.7	----	17	16,496	−64.0	----
80	----	----	----	----	11	17,878	−72.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	12	17,868	−61.2	----
60	----	----	----	----	8	19,592	−65.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

[1] Data not yet received.

*Temperature and relative humidity data for this level are not available or are available only for certain days. See note entitled "Change in Summarization of Radiosonde Data," p. 6, in the January 1946 issue of the MONTHLY WEATHER REVIEW.

NOTE.—All observations scheduled between 0300 and 0500, G. C. T. except at Ciudad Victoria, Mazatlan, and Merida, where they are taken near 0200, G. C. T. "Number of observations" refers to those of dynamic height only. (In a few cases temperature or humidity data may be missing for one or more standard pressure surfaces of some observations.) Relative humidity data are not published for standard pressure surfaces having a corresponding mean temperature below −20° C. Relative humidity data, beginning with October 1, 1948, were computed and expressed in these tables on the basis of the vapor pressure over water. Upper air values of relative humidity at levels with temperatures less than 0° C. have formerly been computed and expressed on the basis of the vapor pressure over ice. All relative humidity observations are obtained by electric hygrometer and have been adjusted to compensate for the values occurring below the operating range of the humidity element. For explanation of the adjustment see article entitled "Curve Method for Obtaining Monthly Means of Relative Humidity," p. 241, MONTHLY WEATHER REVIEW, December 1944.

None of the means included in these tables are based on less than 15 observations at the surface or 5 observations at a standard pressure level.

TABLE 2.—*Free-air resultant winds based on pilot balloon observations made near 2200 G. C. T., during September 1949. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second.*

Altitude (meters) m. s. l.	Abilene, Tex. (534 m.)			Albuquerque, N. Mex. (1,627 m.)			Atlanta, Ga. (299 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (505 m.)			Boise, Idaho (868 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (100 m.)			Charleston, S. C. (16 m.)			Cincinnati, Ohio (273 m.)			Denver,[1] Colo. (1,618 m.)			El Paso, Tex. (1,198 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	119	2.1	30	218	2.5	30	27	1.3	29	255	0.4	30	272	2.1	30	312	4.2	30	88	4.3	30	248	4.9	30	211	2.1	29	126	1.5	30	238	1.3	---	---	---	30	147	1.8
500							30	32	1.6	---	---	---							30	92	4.7	30	250	6.9	30	225	4.3	29	100	1.3	30	252	2.0						
1,000	30	146	3.2	---	---	---	30	46	1.0	---	---	---	30	279	3.8	30	306	3.7	28	101	3.8	28	248	7.6	30	239	5.5	26	313	.8	30	252	2.8						
1,500	27	187	2.6				28	320	.6	29	276	1.7	28	273	4.6	30	295	2.1	25	96	3.2	25	251	7.9	28	248	6.6	25	296	2.2	30	261	4.4				30	133	1.9
2,000	25	186	1.1	30	233	2.3	25	257	1.5	28	269	3.1	28	285	6.0	30	257	1.6	24	95	2.3	21	253	8.2	21	249	8.1	22	282	3.8	28	262	6.0				30	80	1.1
2,500	23	204	2.3	30	231	2.9	25	255	3.3	27	281	5.3	27	292	7.1	30	247	2.6	20	103	2.7	15	254	8.8	15	247	10.4	21	276	5.4	25	264	8.1				29	108	1.7
3,000	23	237	2.2	30	248	1.3	25	267	4.7	27	285	7.0	25	295	8.1	29	244	3.9	19	93	3.2	11	259	10.4	15	255	11.5	20	277	5.8	22	263	10.3				29	73	1.0
4,000	21	294	2.0	28	283	2.9	21	272	5.3	24	288	9.4	24	293	10.6	29	244	5.8	15	91	4.0	---	---	---	12	262	13.6	19	264	6.6	19	272	11.7				28	98	1.5
5,000	19	236	3.9	28	286	5.1	18	276	6.7	22	293	13.2	21	300	12.9	29	248	8.1	13	65	2.7	---	---	---	---	---	---	18	266	7.8	18	274	13.7				25	279	.8
6,000	18	302	4.2	26	248	5.8	17	278	7.6	19	291	13.4	17	308	10.6	26	258	11.3	10	120	1.6	---	---	---	---	---	---	16	277	7.7	16	277	15.0				25	245	3.7
8,000	13	274	6.5	22	290	9.5	13	274	11.6	---	---	---				19	266	12.3	---	---	---	---	---	---	---	---	---	12	277	10.6	11	268	15.3				19	274	7.2
10,000	---	---	---	18	289	13.4	10	270	14.2	---	---	---							---	---	---	---	---	---	---	---	---	---	---	---	---	---	---				17	298	12.0
12,000	---	---	---	15	277	16.5	---	---	---	---	---	---							---	---	---	---	---	---	---	---	---	---	---	---	---	---	---				11	273	19.8

Altitude (meters) m. s. l.	Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,475 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (767 m.)			Jacksonville, Fla. (16 m.)			Joliet, Ill. (178 m.)			Las Vegas, Nev. (663 m.)			Little Rock, Ark. (88 m.)			Medford, Oreg. (416 m.)			Miami, Fla. (11 m.)			Mobile, Ala. (66 m.)			Nashville, Tenn. (182 m.)			New York, N. Y. (15 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	220	2.3	30	279	1.7	28	350	1.0	30	287	2.8	26	59	3.1	29	237	2.5	30	202	2.4	27	74	2.1	29	318	1.7	30	110	3.3	29	80	1.8	29	311	0.7	28	307	1.7
500							28	328	1.4	---	---	---	26	66	3.2	29	235	4.2	---	---	---	27	53	2.6	28	319	1.7	30	116	4.1	29	103	1.4	29	332	.5	28	273	2.5
1,000	---	---	---	---	---	---	28	304	1.3	30	289	3.7	25	92	1.3	28	241	5.5	30	196	3.6	26	351	.7	28	286	.5	30	126	3.8	25	119	1.1	28	309	1.0	28	284	3.9
1,500				30	278	1.8	28	285	1.5	30	282	4.3	19	263	2.1	28	257	6.2	30	204	4.2	24	4	1.3	27	201	1.3	28	123	3.1	23	163	.6	26	253	1.2	25	280	5.9
2,000	30	226	2.6	30	280	2.7	26	287	2.6	30	287	5.0	17	258	4.1	26	262	8.0	30	210	4.8	23	6	.9	26	208	2.7	28	125	2.6	19	225	.6	25	261	1.8	23	287	7.8
2,500	30	225	3.4	30	273	3.1	24	286	4.9	27	293	5.9	16	254	4.4	24	273	9.7	30	213	4.7	21	13	2.4	25	225	3.8	26	143	1.5	13	335	1.4	24	275	3.6	21	285	7.5
3,000	30	221	4.1	30	260	4.5	23	283	6.2	23	290	6.2	15	250	3.8	22	278	10.2	30	222	5.6	21	316	4.2	24	230	4.4	26	139	2.0	10	308	2.3	22	288	5.5	19	281	8.4
4,000	29	227	5.4	28	257	7.0	21	285	7.8	20	288	7.5	---	---	---	20	281	12.3	30	232	6.9	17	333	5.6	21	251	4.6	22	165	2.5	---	---	---	19	280	9.3	10	277	8.9
5,000	24	241	5.7	27	264	8.5	17	285	9.4	16	293	10.4	---	---	---	16	283	13.8	29	247	7.6	15	306	8.4	21	246	5.8	17	187	2.4	---	---	---	16	272	9.8	---	---	---
6,000	20	250	9.6	23	266	9.4	16	286	11.9	12	295	7.3	---	---	---	10	277	19.0	26	241	10.0	12	342	8.8	20	256	8.5	16	208	1.5	---	---	---	15	274	11.8	---	---	---
8,000	15	266	12.6	15	278	12.7	---	---	---	---	---	---	---	---	---	---	---	---	24	245	12.5	---	---	---	15	293	8.1	---	---	---	---	---	---	10	283	17.6	---	---	---
10,000	12	268	15.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	16	266	15.9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
12,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	10	275	16.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Altitude (meters) m. s. l.	Oakland, Calif. (8m.)			Oklahoma City, Okla. (396 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (338 m.)			Rapid City, S. Dak. (982 m.)			St. Cloud, Minn. (318 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (240 m.)			San Diego, Calif. (13 m.)			Sault Ste. Marie, Mich. (221 m.)			Seattle, Wash. (116 m.)			Spokane, Wash. (725 m.)			Washington, D. C. (24 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	280	4.5	29	157	2.8	29	231	1.5	30	191	0.5	29	335	2.0	27	254	3.0	30	270	0.6	30	130	3.3	29	270	3.2	30	272	3.4	29	326	1.5	30	244	0.9	30	278	1.0
500	30	270	2.9	29	161	3.7	29	231	2.3	30	203	.8	---	---	---	27	261	3.9	30	278	1.4	30	95	2.8	29	275	2.2	30	264	4.7	29	276	.7	---	---	---	30	314	1.3
1,000	27	232	2.4	28	159	4.8	28	241	3.3	30	178	.9	29	333	1.9	27	276	5.3	28	270	2.3	30	94	2.4	28	244	1.8	29	262	6.6	29	207	1.5	30	238	1.7	29	296	2.2
1,500	26	203	2.2	27	147	4.9	26	250	4.7	30	188	1.0	29	292	.9	25	272	6.7	27	277	4.1	30	136	3.3	27	237	2.2	26	265	7.4	27	156	1.2	29	243	1.8	27	282	3.3
2,000	26	212	2.1	26	339	3.4	24	272	6.5	30	198	1.1	28	276	3.1	22	283	9.4	25	274	5.9	29	135	3.1	26	227	3.1	22	268	10.1	23	126	.6	28	250	2.7	25	269	5.1
2,500	26	216	2.8	26	244	3.9	22	287	8.7	28	214	1.1	28	274	5.6	18	286	10.5	23	275	7.2	25	125	2.7	26	217	3.5	17	277	10.3	21	34	.3	27	252	2.7	22	274	7.1
3,000	26	224	2.7	26	248	2.9	21	293	10.2	27	182	1.0	28	282	8.0	18	287	11.1	23	275	8.8	21	170	1.6	26	211	4.1	12	295	11.5	20	360	.6	26	259	3.9	22	275	8.4
4,000	24	259	3.3	23	292	4.3	20	305	13.2	26	208	1.5	24	292	10.8	17	291	14.0	20	294	11.7	19	180	.1	21	213	6.5	11	299	15.4	17	319	1.3	22	259	7.5	19	276	12.0
5,000	22	265	5.1	21	299	6.5	18	303	15.2	25	234	2.8	21	288	13.0	16	292	15.8	18	299	13.7	15	338	1.1	19	233	8.7	---	---	---	16	309	2.6	20	268	8.6	18	279	14.6
6,000	20	258	6.0	---	---	---	14	296	14.9	24	256	3.8	18	293	16.8	14	283	14.8	17	290	15.0	10	227	1.6	18	232	8.5	---	---	---	15	313	4.9	18	271	8.3	18	274	16.2
8,000	15	247	6.8	---	---	---	12	296	18.5	20	269	5.4	11	292	17.0	---	---	---	11	282	17.3	---	---	---	14	255	10.5	---	---	---	---	---	---	13	303	7.5	11	270	16.8
10,000	12	244	12.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	11	257	12.9	---	---	---	---	---	---	---	---	---	---	---	---

[1] Weather Bureau pilot balloon observations discontinued at Denver, Colorado.

TABLE 3.—*Free-air resultant winds based on rawin observations made near 0300 G. C. T., during September 1949. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,636 m.)			Big Spring, Tex. (774 m.)			Bismarck, N. Dak. (505 m.)			Brownsville, Tex. (7 m.)			Caribou, Maine (191 m.)			Charleston, S. C. (13 m.)			Columbia, Mo. (237 m.)			Grand Junction, Colo. (1,473 m.)			Greensboro, N. C. (275 m.)			Hatterns, N. C. (3 m.)			International Falls, Minn. (358 m.)			Little Rock, Ark. (80 m.)			Medford, Oreg. (401 m.)		
	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed	Observations	Direction	Speed
Surface	30	129	3.1	30	121	3.3	30	326	0.7	29	46	2.9	30	223	1.2	30	342	0.2	30	120	1.3	30	56	1.0	30	17	1.2	30	90	0.5	30	254	1.1	30	65	1.1	30	336	2.0
500										28	93	6.0	30	235	4.7	30	85	1.1	30	177	2.0	---	---	---	30	17	1.7	30	169	1.1	30	262	3.2	30	94	3.4	30	332	2.3
1,000	---	---	---	30	130	5.9	29	303	3.2	29	100	5.4	30	249	6.2	30	67	1.1	30	236	1.6	---	---	---	30	338	1.3	30	215	2.2	30	284	7.7	30	63	2.7	30	319	3.2
1,500				30	141	6.6	29	299	6.0	30	86	3.8	29	255	7.2	30	298	.8	30	273	3.5	30	64	.9	30	280	2.2	29	228	3.2	30	292	9.2	30	90	1.4	30	300	2.0
2,000	30	174	3.4	30	172	4.2	29	302	7.8	29	77	3.4	28	259	7.2	30	281	2.4	30	281	5.5	30	252	.1	30	264	3.2	29	238	3.8	30	299	9.7	30	172	1.5	30	260	1.7
2,500	30	216	4.2	30	205	3.0	29	306	8.7	29	70	3.3	28	256	8.3	30	264	2.7	30	289	7.6	30	272	1.6	30	252	4.3	29	247	4.7	29	296	10.0	29	281	2.7	30	238	2.9
3,000	30	239	3.2	30	229	1.5	29	304	9.1	28	71	3.3	28	251	9.4	30	270	3.6	30	291	9.2	30	263	3.0	30	258	5.8	29	247	5.9	29	304	11.1	29	288	3.9	30	232	3.5
4,000	30	285	2.6	30	314	1.4	27	299	10.4	28	81	3.1	27	249	10.2	30	271	5.3	30	297	10.9	30	264	4.8	30	264	6.9	27	249	8.6	28	305	13.6	29	315	7.8	30	260	5.2
5,000	30	299	6.1	30	8	2.0	27	297	12.9	29	86	3.3	27	248	13.3	29	274	5.9	29	295	12.5	30	269	6.8	30	265	9.6	26	251	9.6	26	298	13.8	28	294	8.0	28	263	6.7
6,000	30	296	6.8	29	330	2.3	27	300	14.3	29	53	2.4	27	251	14.4	28	278	7.8	29	292	14.4	30	266	8.6	29	265	11.0	23	252	9.9	26	294	15.2	28	300	9.6	26	279	6.6
8,000	29	288	6.7	29	305	6.7	21	290	15.1	27	338	.4	26	247	19.3	26	284	9.7	24	276	17.9	29	268	12.1	26	269	13.9	21	252	12.9	22	299	18.3	28	273	12.3	24	273	9.7
10,000	28	280	10.1	25	277	11.1	19	284	17.5	24	269	3.8	23	246	24.0	24	274	11.5	22	274	23.7	23	269	14.7	25	268	17.0	16	248	18.2	18	304	24.3	27	251	17.0	19	253	8.4
12,000	22	265	13.9	23	251	16.6	19	281	18.8	24	250	6.2	17	252	23.9	21	267	16.0	19	274	27.6	19	270	18.7	22	269	22.5	12	264	20.0	11	293	21.8	25	253	19.4	16	253	13.2
14,000	13	262	13.8	18	267	17.5	14	295	14.4	17	347	2.9	15	256	15.2	16	275	13.0	10	271	24.3	10	273	16.5	12	279	17.5	10	267	15.3	---	---	---	21	280	20.4	---	---	---
16,000	---	---	---	---	---	---	11	290	12.7	---	---	---	---	---	---	10	291	5.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	14	273	20.5	---	---	---

TABLE 3.—*Free-air resultant winds based on rawin observations made near 0300 G. C. T., during September 1949. Directions given in degrees from north (N=360°, E=90°, S=180°, W=270°). Speeds in meters per second*—Continued

Altitude (meters) m. s. l.	Miami, Fla. (12 m.)			Nantucket, Mass. (14 m.)			Nashville, Tenn. (180 m.)			New Orleans, La. (6 m.)			Oakland, Calif. (8 m.)			Oklahoma City, Okla. (392 m.)			Rapid City, S. Dak. (980 m.)			San Antonio, Tex. (242 m.)			San Juan, P. R. (28 m.)			St. Cloud, Minn. (318 m.)			Santa Maria, Calif. (72 m.)			Sault Ste. Marie, Mich. (221 m.)			Spokane, Wash. (726 m.)		
Surface	30	100	1.7	30	250	0.9	30	248	0.4	30	124	2.5	30	280	3.6	30	113	2.7	30	350	0.9	30	103	3.1	29	112	2.1	30	273	0.6	30	271	2.0	30	267	0.6	30	195	0.9
500	30	116	4.7	30	242	3.4	30	102	.5	29	93	3.6	29	278	3.7	28	118	3.1	---	---	---	30	113	5.3	29	100	5.9	30	254	2.3	30	328	3.0	30	246	4.0	---	---	---
1,000	30	120	4.6	30	247	4.7	30	202	1.6	29	84	3.8	29	280	3.3	28	154	4.7	30	350	.9	30	109	4.9	29	98	6.2	30	271	5.9	30	340	2.6	30	258	7.3	30	205	.6
1,500	30	122	3.6	30	239	5.8	30	246	2.4	29	69	3.4	29	278	2.1	28	161	3.2	30	313	1.7	30	96	3.5	29	98	6.0	29	283	8.2	30	16	1.2	28	265	8.3	30	260	1.4
2,000	30	126	3.2	30	245	7.5	30	271	3.9	29	66	1.9	29	251	1.5	30	229	3.6	30	293	3.5	30	99	2.1	29	95	5.6	29	292	8.4	30	41	.3	28	272	9.3	30	265	1.7
2,500	30	133	3.4	30	248	7.9	30	279	4.9	29	50	.9	29	250	2.2	30	250	3.3	30	286	5.9	30	87	1.4	29	93	5.6	29	288	8.7	30	254	1.6	28	273	10.2	29	278	2.1
3,000	30	129	3.6	30	248	8.9	30	274	6.1	29	32	.9	29	249	2.5	30	272	3.2	30	284	8.0	30	27	.6	29	93	5.6	29	291	9.8	30	246	3.3	28	274	11.1	29	276	3.2
4,000	30	128	3.0	29	243	10.5	30	285	8.3	28	273	2.0	29	262	2.4	29	310	4.5	30	288	12.0	30	60	1.3	29	89	4.9	28	292	11.9	28	246	5.9	28	277	13.2	29	267	5.4
5,000	29	124	2.3	28	243	12.1	30	285	10.7	27	307	4.5	28	260	3.8	29	309	5.6	29	293	12.7	29	277	.3	28	89	3.4	27	291	13.8	28	249	7.6	28	276	14.3	28	277	5.9
6,000	29	89	1.6	27	243	13.2	29	280	11.8	26	301	4.0	26	253	6.5	29	303	8.0	28	295	16.3	28	233	1.9	27	103	3.4	26	289	15.4	28	247	9.1	26	277	15.3	28	285	6.6
8,000	28	34	1.7	21	246	19.2	29	278	16.0	24	278	6.4	24	265	10.7	27	298	12.0	24	281	16.6	27	270	4.8	27	125	2.2	22	290	17.1	27	257	14.2	25	280	19.5	24	310	4.9
10,000	28	11	3.0	---	---	---	29	277	21.9	23	242	11.6	22	263	12.4	26	260	16.5	18	278	17.0	26	288	7.5	27	135	.2	20	283	18.0	23	255	18.8	18	285	20.2	21	307	2.8
12,000	28	329	5.3	---	---	---	26	276	25.5	22	261	12.5	18	265	16.5	24	248	19.2	15	273	19.0	24	264	11.8	26	332	1.9	16	284	18.7	16	258	18.9	14	289	19.2	17	293	7.3
14,000	24	336	6.6	---	---	---	13	281	28.9	16	285	13.3	---	---	---	17	253	16.0	11	272	15.3	17	296	15.3	22	332	1.2	12	300	17.3	14	263	16.8	---	---	---	13	295	7.5
16,000	13	14	2.9	---	---	---	---	---	---	11	272	8.5	---	---	---	---	---	---	---	---	---	10	266	10.7	18	66	3.8	---	---	---	---	---	---	---	---	---	---	---	---

Altitude (meters) m. s. l.	Tatoosh Island, Wash. (33 m.)		
	Observations	Direction	Speed
Surface	30	186	2.0
500	30	266	1.4
1,000	30	261	1.5
1,500	30	247	1.5
2,000	30	265	2.0
2,500	29	274	2.5
3,000	28	286	3.0
4,000	28	283	4.1
5,000	28	284	4.4
6,000	26	288	4.5
8,000	25	300	4.1
10,000	21	288	5.5
12,000	16	273	4.4

NOTE.—Resultants prepared from rawins at high altitudes are biased toward lower wind speeds. Values appearing in this table should therefore be used with caution when the number of observations missing is greater than three. See note following Table 3 in the June 1948 issue of the MONTHLY WEATHER REVIEW.

LATE REPORT FOR AUGUST 1949

TABLE 1

Standard pressure surface (mb.)	Swan Island, W. I. (1,013.0 mb.)			
	Number of observations	Dynamic height	Temperature	Relative humidity
Surface	31	10	27.4	81
1,000	31	124	26.6	82
950	31	580	23.6	82
900	31	1,049	20.8	80
850	31	1,542	18.0	73
800	31	2,060	15.2	65
750	31	2,609	12.3	55
700	31	3,181	9.3	54
650	31	3,796	5.8	52
600	31	4,443	2.1	49
550	31	5,141	−1.8	45
500	31	5,893	−6.2	42
450	31	6,719	−11.4	37
400	31	7,603	−17.7	39
350	31	8,588	−24.6	---
300	31	9,691	−32.7	---
250	31	10,949	−42.4	---
200	31	12,419	−54.2	---
175	29	13,261	−60.5	---
150	24	14,201	−66.5	---
125	19	15,298	−71.5	---
100	16	16,611	−73.0	---
80	6	17,931	−70.6	---

RIVER STAGES AND FLOODS FOR SEPTEMBER 1949

No major floods occurred during September. Most of the flooding was due to flash rises in several areas resulting from heavy showers. The most destructive of these occurred in Bernalillo, N. Mex., during the early morning hours of the 30th. These floods were not as destructive as those which occurred during June but were more destructive and numerous than one year ago.

Atlantic slope drainage.—Heavy rains (2 to 3 inches) during the latter part of the first week in the headwaters caused light flooding on the Saluda at Pelzer and Chappells, S. C., and on the Broad River at Blairs, S. C. No damages resulted.

East Gulf of Mexico drainage.—Very heavy rains (up to 5 inches or more) in the headwater streams of the Chattahoochee River, caused widespread flooding from Norcross, Ga., northeastward on the 5th and 6th. Most of the tributaries and the main channel of the Chattahoochee above Norcross reached flash flood proportions shortly after the rains. No important high water occurred below Norcross on the Chattahoochee or at other points on major streams. Considerable damage resulted from these flash floods.

Heavy rains over the headwater areas during the 24-hour period ending at 7 a. m. on the 6th caused moderate to sharp rises over the Etowah, Oostanaula and upper Coosa Rivers, wit'ı light flooding on the Etowah River at Canton, Ga. No damages resulted from the high water.

Light flooding occurred on the Pearl River at Bogalusa, La., on the 8th, and again on the 11th and 12th. The first overflow was due to heavy rains which resulted from the tropical disturbance moving inland over southeastern Louisiana, on the morning of the 4th. The second overflow was due to heavy thundershowers over the local area on the 9th.

Missouri Basin.—Intense thundershowers (2 to 3 inches) north of Sioux City, Iowa, on the afternoon of the 3rd caused Perry Creek to rise to bankfull stage within a few hours. Most of the rain fell in one hour. Several streets were flooded in northwest Sioux City due to run-off from the hills and to water backing up into the streets from the sewers.

Heavy rain (4 to 5 inches) again fell over the Perry Creek basin on the 10th and 11th causing more serious flooding than during the first storm. The flooding again was mainly due to the water backing up into the streets from the sewers. Damages were confined mostly to bridges, heavy deposits of mud on streets and lawns, and the flooding of basements.

The Floyd River overflowed its banks from the vicinity of Merrill to near James, Iowa, due to heavy rain on the 10th and 11th. The heaviest rain occurred along the lower portion of the basin. LeMars and Merrill, Iowa, reported over 5 inches of rain during the 24-hour period ending at 8 a. m. on the 11th. About 1,500 acres of land were inundated, most of it pasture land, and willow wooded areas. Losses were not heavy.

Light flooding occurred along the Big and Little Blue Rivers in Nebraska and for a short distance into Kansas during the first half of the month. Slight flooding occurred on the Republican at Cambridge, Nebr., and along the Delaware River at Valley Falls, Kans. Losses were negligible.

Flood stages were exceeded on the Chariton, Grand, Weldon, and Thompson Fork Rivers in northwestern Missouri, the Lamine and Blackwater Rivers in central Missouri, and the Stranger Creek in northeastern Kansas, due to the heavy rain (5 to 6 inches) during the night of the 11th and 12th. An unofficial 8-inch fall in the headwaters of the Stranger Creek just south of Atchison, Kans., caused 2- to 3-foot overflows in that area and bankfull stages downstream to Tonganoxie. The Weldon River rose 12 feet during the early morning hours of the 12th at Mercer, Mo., but no flooding occurred except in the smaller streams to the north. Damages from the flooding were small except in the area south of Atchison, Kans., where 1,000 acres were inundated.

Arkansas Basin.—Minor flooding occurred on the upper Chikaskia on the 6th and 12th and on the Caney River above Hulah, Okla., on the 19th. The first overflow on the Chikaskia resulted from rains averaging about 3 inches during the 48-hour period ending on the 5th, and the second to rain averaging less than 1 inch. The damage from the overflows was negligible.

West Gulf of Mexico drainage.—A flash flood occurred in Bernalillo, N. Mex., during the early morning hours of the 30th. This flood was due to heavy thunder showers in the nearby Sandia Mountains. The Bernalillo and Sandia irrigation canals were destroyed as the water poured down the Sandia Mountains through numerous gullies and arroyos. A convent and 10 homes were destroyed and considerable land was flooded.

FLOOD STAGE REPORT FOR SEPTEMBER 1949

[All dates in September unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest [1]	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
Roanoke:	*Feet*			*Feet*	
Weldon, N. C.	31	1	1	32.4	1
Williamston, N. C.	10	3	11	10.9	7,8
Tar: Enfield, N. C.	14	Aug. 31	1	14.4	1
Neuse:					
Smithfield, N. C.	13	Aug. 29	3	19.0	Aug 31
Goldsboro, N. C.	14	1	12	20.7	5
Kinston, N. C.	14	4	15	17.7	8
Cape Fear: Lock No. 2, Elizabethtown, N. C.	20	Aug. 30	Aug. 31	30.0	Aug. 31
Yadkin: Wilkesboro, N. C.	14	Aug. 29	Aug. 29	17.1	Aug. 29
Pee Dee: Pee Dee, S. C.	19	Aug. 24	4	21.9	4
Saluda:					
Pelzer, S. C.	6	6	12	9.2	7
Chappells, S. C.	13	10	10	14.2	10
Broad: Blairs, S. C.	14	8	8	16.0	8
Edisto: Givhans Ferry, S. C.	10	Aug. 28	4	14.4	4
EAST GULF OF MEXICO DRAINAGE					
Chattahoochee: Norcross, Ga.	16	8	8	19.4	8
Pearl: Bogalusa, La.	15	8	8	15.0	8
		11	12	15.2	12
MISSISSIPPI SYSTEM					
Missouri Basin					
Floyd: James, Iowa	14	11	13	18.1	12
Republican: Cambridge, Nebr.	5	1	1	6.2	1
Little Blue:					
Endicott, Nebr.	9	6	8	12.2	7
Hanover, Kans.	14	7	7	14.2	8
Big Blue:					
Crete, Nebr.	16	11	12	17.8	11
Barnston, Nebr.	18	7	7	20.3	7
		12	13	20.4	12
Blue Rapids, Kans.	20	8	8	21.8	8
		12	13	22.0	12-13
Delaware: Valley Falls, Kans.	22	12	13	22.9	12
Stranger Creek: Tonganoxie, Kans.	23	15	15	23.1	15
Grand:					
Chillicothe, Mo.	18	13	13	19.1	13
Sumner, Mo.	25	13	13	25.1	13
Brunswick, Mo.	12	14	14	12.2	14
Chariton: Novinger, Mo.	20	12	13	21.3	13
Lamine: Clifton City, Mo.	15	12	13	18.0	13
Blackwater: Blue Lick, Mo.	25	15	15	25.0	15
Arkansas Basin					
Caney: Hulah, Okla.	30	19	19	33.4	19

[1] Provisional.

ESTIMATED FLOOD LOSSES FOR 1947 [1]

Monetary losses from floods in the United States, estimated at $272,000,000, was slightly greater than in 1944 and 1945 combined and four times greater than in 1946. It was the 4th greatest monetary loss from floods since 1924, being exceeded in 1927, 1936, and 1937. The loss in life was greater than in 1944, and 1946, but less than in 1945, when 91 lives were lost as compared with 55 during 1947.

The major flood event of the year occurred in the Middle West in the lower Missouri and middle Mississippi Rivers in June and July. It was one of the most disastrous floods on record with the Mississippi reaching its highest stage since 1844, at St. Louis, Mo. Record stages were reached on several streams, including the Des Moines and Raccoon in Iowa, the Platte in Nebraska, the Grand River in Missouri, and also at a few stations on the Mississippi and Missouri Rivers.

[1] Flood loss statistics for 1944 and 1945 were published in the June 1948 and for 1946 in the September 1948 issues of the Monthly Weather Review. The issues in which flood losses previous to 1944 were published are indicated in vol. 73, No. 8, August 1945.

ESTIMATED FLOOD LOSSES FOR 1947

TABLE 1

River and drainage	Urban property					Rural property					Other property		Miscellaneous	Unclassified	Total loss	Lives lost
	Residential		Commercial		Public	Crops		Live-stock	Other		RR's, bridges, highways, etc.	Public Utilities				
	Fixed	Movable	Fixed	Movable		Growing	Stored		Fixed	Movable						
HUDSON BAY DRAINAGE																
Red River of the North	$140,300	$6,400	$13,500		$313,500	$15,000					$275,000	$10,000	$13,100		$786,800	
ST. LAWRENCE DRAINAGE																
Lake Michigan																
Menomonee River											2,000				2,000	
Grand, Red Cedar and Flat Rivers	336,000	12,500	320,500	$4,700	187,500				$2,000	$200	48,200		34,600		946,200	1
Kalamazoo River	161,500		670,400	17,000	9,500	1,000		$1,000	12,000		56,000	55,000	17,200		1,000,600	
Paw Paw River and Ox Creek	5,000		132,000		92,000										229,000	
Total	502,500	12,500	1,122,900	21,700	289,000	1,000		1,000	14,000	200	106,200	55,000	51,800		2,177,800	1
Lake Huron																
Saginaw River and tributaries	16,900		4,600	12,500	4,200	10,000			2,000		1,400	5,700	42,500		99,800	
Bad River	5,000		3,000	3,000									5,000		16,000	
Clinton River	151,000		50,000	58,000	52,000	20,000		5,000	50,000	10,000	100,000	10,000	175,000		681,000	
Total	172,900		57,600	73,500	56,200	30,000		5,000	52,000	10,000	101,400	15,700	222,500		796,800	
Lake Champlain																
East Creek (Vermont)														$2,000,000	2,000,000	
ATLANTIC SLOPE DRAINAGE																
Androscoggin, Kennebec, St. John, and Penobscot Rivers	4,000			5,000							4,000				13,000	
Connecticut River											75,000		5,000		80,000	
Lackawaxen River														5,000	5,000	
Susquehanna River														100,000	100,000	
Cape Fear, Tar, Neuse, and Roanoke Rivers		500	20,000	20,000	230,000	25,000	$100,000	1,100	1,100		7,500		52,500		457,700	
Santee River and tributaries	3,000		3,000		10,000	468,500							2,000		486,500	
Total	7,000	500	23,000	25,000	240,000	493,500	100,000	1,100	1,100		86,500		59,500	105,000	1,142,200	
EAST GULF OF MEXICO DRAINAGE																
Apalachicola River													15,000		15,000	
Choctawhatchee River						10,000		2,700			117,500				130,200	
Alabama River and tributaries	35,000	10,000	5,000	5,000	5,000	20,000	3,000	1,000			10,000	1,000	17,000		112,000	
Black Warrior and Tombigbee Rivers					5,000	284,800		2,000	11,800	500	3,500		15,500		323,100	
Pearl, Pascagoula and tributaries	1,000				5,000			11,000	8,000	1,500	23,000	1,500	22,800		73,800	
Total	36,000	10,000	5,000	5,000	15,000	314,800	3,000	16,700	19,800	2,000	154,000	2,500	70,300		654,100	2
MISSISSIPPI SYSTEM																
Upper Mississippi Basin																
Zumbro and Whitewater Rivers	400	200			200	500			100		3,500		100		5,000	
Trempealeau River	2,500					800			2,000		15,000		500		20,800	1
Root River											2,000				2,000	
Kickapoo River	800					45,400			200		1,000				47,400	
Iowa, Maquoketa, Turkey and Wapsipinicon Rivers	277,500	29,000	114,000	203,000	1,278,500	4,419,200	57,000	54,000	834,000	105,000	2,885,000	82,700	178,400		10,517,300	1
Grand and Platte Rivers in Wisconsin; Rock, Galena, and Edwards Rivers in Illinois	155,200	21,100	15,200	41,100	20,200	665,300		1,000	82,800	3,000	300,700	5,200	1,100		1,311,900	
Skunk River						3,500,000					10,000			684,400	4,194,400	
Des Moines River						5,522,500	2,000		1,000	1,000	3,000		3,472,500	17,368,300	26,370,300	25
Fox River						529,500					10,000			350,400	889,900	
Fabius and Wyaconda Rivers						803,900			5,200		200		600	293,700	1,103,600	
Bear Creek													302,000	312,500	614,500	
Salt River					5,000	555,100			300	100				43,000	603,500	
Cuivre River						66,000								4,000	70,000	
Illinois River						2,370,700							6,000	510,500	2,887,200	
Meramec River						309,200								247,000	556,200	
Kaskaskia River						272,800								500	273,300	
Mississippi River (Upper)	5,000		2,600			23,155,900		99,500	1,000				3,226,000	11,979,600	38,469,600	
Total	441,400	50,300	131,800	244,100	1,303,900	42,216,800	59,000	154,500	926,600	109,100	3,230,400	87,900	7,187,200	31,793,900	87,936,900	27

ESTIMATED FLOOD LOSSES FOR 1947—Continued

River and drainage	Urban property					Rural property					Other property		Miscellaneous	Unclassified	Total loss	Lives lost
	Residential		Commercial		Public	Crops		Livestock	Other		RR's, bridges, highways, etc.	Public Utilities				
	Fixed	Movable	Fixed	Movable		Growing	Stored		Fixed	Movable						
Missouri Basin																
Yellowstone River and tributaries			$2,300		$900	$23,100					106,200		$12,000	$182,000	$326,500	
Little Missouri River	$4,800		2,200		7,600			$15,100	$72,000	$2,400	8,200		17,900		130,200	
Knife and Heart Rivers	6,700		4,000		6,500	1,300		[2] 3,100	13,100	400	26,800		25,500	1,000	88,400	
Cannonball, Grand and Moreau Rivers					1,000	7,800		54,300	6,000	100	20,500		4,200	34,300	128,200	
Cheyenne River and tributaries	24,200		130,300		58,200	1,300			5,400	900	111,000	$8,500	15,000		354,800	
White River						40,000							8,000	15,200	63,200	
Ponca and Keyapaha Creeks (South Dakota)						36,300							16,700	75,600	128,600	
Verdigre River						38,300							121,900	307,800	468,000	
James River						618,000							108,000	102,500	828,500	
Big Sioux River						71,900	$61,800						47,000	181,700	362,400	
Floyd River						60,000							11,000	52,900	123,900	
Little Sioux River						187,100							52,000	159,600	398,700	
Wood River						489,700							126,200	351,500	967,400	
Mosquito Creek (Iowa)						37,300							753,000	97,800	888,100	
Loup River						101,500		3,500					360,800	2,005,700	2,471,500	
Elkhorn River and tributaries	100					340,000	2,000		800		23,500		152,000	675,700	1,194,100	
Papillion Creek (Nebraska)						76,500							65,600	360,900	503,000	
Platte River and tributaries						6,840,500		[1] 127,200					486,900	2,771,900	10,226,500	
Keg Creek (Iowa)						10,000							3,100	10,400	23,500	
Weeping Water Creek (Nebraska)						260,100							179,600	346,100	785,800	
Indian Creek (Iowa)													41,800	278,800	320,600	
Nishnabotna River						4,000,000							2,470,000	4,800,900	11,270,900	2
Nemaha River and tributaries						3,516,800		[1] 95,900						789,900	4,402,600	1
Tarkio River and tributaries						634,200		[1] 8,300					300	53,800	696,600	
Nodaway River and tributaries						2,844,000		[1] 109,600						1,026,100	3,979,700	
Republican River and tributaries						10,063,100		[1] 1,157,000						2,907,400	14,127,500	14
Solomon River						709,500		2,800						4,300	716,600	
Little Blue and Big Blue Rivers						2,505,100		44,500					5,700	627,700	3,183,000	
Kansas River and minor tributaries						1,864,500		[1] 13,100						60,300	1,937,900	
Blue River and tributaries								[1] 23,900					1,100	55,100	80,100	1
Fishing River and tributaries						616,000		[1] 26,400					10,000	532,900	1,185,300	
Grand River and tributaries						19,979,300		[1] 162,500					24,200	3,561,500	23,727,500	
Chariton River						8,317,400		[1] 91,300					200	525,700	8,934,600	
Lamine River						676,200		[1] 3,500						5,200	684,900	
Osage River and tributaries						2,344,700		[1] 26,800					24,000	169,500	2,565,000	
Gasconade River						845,300		[1] 67,900						59,600	972,800	
Missouri River	15,600		5,700		44,200	44,044,100		[1] 1,252,400	132,100	9,200	19,900	300	1,312,900	17,092,500	63,928,900	
Total	51,400		144,500		118,400	112,200,900	63,800	3,289,100	229,400	13,000	316,100	8,800	6,456,600	40,283,800	163,175,800	18
Ohio Basin																
Allegheny River	712,900	312,000	541,300	1,035,400	344,400	45,000		2,000	17,000	1,000	168,000	41,300	349,000	750,000	4,319,300	1
Chestnut Creek (SW Virginia)	72,000		158,300		5,000						3,200		9,000		247,500	
Kentucky River	20,000	15,000		1,000		20,000	5,000	500	10,000	4,000		1,500	13,000		90,000	
Blue River and Brock Creek (Indiana)														500,000	500,000	
Wabash River						308,000				6,000	1,000			2,000	317,000	
Cumberland River	97,100		234,000		8,500	260,500			106,500			19,000	15,000		740,600	2
Small streams in area of Green County, Tennessee	1,800	500	5,000	13,000		1,500,000			2,000		1,000	2,000	5,400		1,530,700	2
Tennessee River and tributaries	600		200								500		300		1,600	
Ohio River	700					62,500			100				2,400		65,700	
Total	905,100	327,500	938,800	1,049,400	357,900	2,196,000	5,000	2,500	135,600	11,000	173,700	63,800	394,100	1,252,000	7,812,400	5
Arkansas Basin																
Small mountain streams in Pueblo and Huerfano Counties, Colorado	65,000		15,000								145,000				225,000	
Fountain Creek														[3] 100,000	100,000	1
Ninnescah and Chikaskia Rivers								1,000	5,000		216,500				222,500	
Walnut River						11,000			6,000		26,000	20,000			63,000	
Cimarron River						14,000					6,000				20,000	
Verdigris and Caney Rivers			500		1,000	114,000			19,000		12,500		5,700		152,700	
Neosho River						46,600		500	17,500		21,700		23,000		109,300	
Canadian River						15,000					350,000		15,000		380,000	
Arkansas River						104,500			3,500		30,000		13,000		151,000	
Total	65,000		15,500		1,000	305,100		1,500	51,000		807,700	20,000	56,700	100,000	1,423,500	1
Red Basin																
Little River						[3] 1,214,000		2,500	199,000		18,000				1,433,500	
Sulphur River						5,000		1,000	1,000				5,000		12,000	
Total						1,219,000		3,500	200,000		18,000		5,000		1,445,500	

Lower Mississippi Basin																
Yazoo and Tallahatchie Rivers						90,000							200,000	410,000	700,000	
Mississippi River (Lower)	2,000		12,500		5,700	1,405,300	6,000	1,600	14,600	1,700	67,300	500	338,100		1,855,300	1
Total	2,000		12,500		5,700	1,495,300	6,000	1,600	14,600	1,700	67,300	500	538,100	410,000	2,555,300	1
WEST GULF OF MEXICO DRAINAGE																
Nezpique River											20,000				20,000	
Sabine River														300,000	300,000	
Trinity River						700		3,100			5,000		300		9,100	
Guadalupe River							900								900	
Total						700	900	3,100			25,000		300	300,000	330,000	
GULF OF CALIFORNIA DRAINAGE																
Colorado River											3,000				3,000	
PACIFIC SLOPE DRAINAGE																
Columbia Basin																
Flathead River						15,000			8,500		2,500		1,000		27,000	
Kootenai River						55,000					5,000				60,000	
Potlatch River											1,000				1,000	
Total						70,000			8,500		8,500		1,000		88,000	
Grand Total	2,323,600	407,200	2,465,100	1,418,700	2,700,600	160,558,100	237,700	3,479,600	1,652,600	147,000	5,372,800	264,200	15,056,200	76,244,700	272,328,100	55

[1] Includes movable farm propertyy.
[2] Damage to bridges and urban property.
[3] Includes all crop losses.

ESTIMATED FLOOD LOSSES FOR 1947—Continued

River and drainage	Urban property					Rural property					Other property		Miscellaneous	Unclassified	Total loss	Lives lost
	Residential		Commercial		Public	Crops		Live-stock	Other		RR's, bridges, highways, etc.	Public Utilities				
	Fixed	Movable	Fixed	Movable		Growing	Stored		Fixed	Movable						
Missouri Basin																
Yellowstone River and tributaries			$2,300		$900	$23,100					106,200		$12,000	$182,000	$326,500	
Little Missouri River	$4,800		2,200		7,600			$15,100	$72,000	$2,400	8,200		17,900		130,200	
Knife and Heart Rivers	6,700		4,000		6,500	1,300		[2] 3,100	13,100	400	26,800		25,500	1,000	88,400	
Cannonball, Grand and Moreau Rivers					1,000	7,800		54,300	6,000	100	20,500		4,200	34,300	128,200	
Cheyenne River and tributaries	24,200		130,300		58,200	1,300			5,400	900	111,000	$8,500	15,000		354,800	
White River						40,000							8,000	15,200	63,200	
Ponca and Keyapaha Creeks (South Dakota)						36,300							16,700	75,600	128,600	
Verdigre River						38,300							121,900	307,800	468,000	
James River						618,000							108,000	102,500	828,500	
Big Sioux River						71,900	$61,800						47,000	181,700	362,400	
Floyd River						60,000							11,000	52,900	123,900	
Little Sioux River						187,100							52,000	159,600	398,700	
Wood River						489,700							126,200	351,500	967,400	
Mosquito Creek (Iowa)						37,300							753,000	97,800	888,100	
Loup River						101,500		3,500					360,800	2,005,700	2,471,500	
Elkhorn River and tributaries	100					340,000	2,000		800		23,500		152,000	675,700	1,194,100	
Papillion Creek (Nebraska)						76,500							65,600	360,900	503,000	
Platte River and tributaries						6,840,500		[1] 127,200					486,900	2,771,900	10,226,500	
Keg Creek (Iowa)						10,000							3,100	10,400	23,500	
Weeping Water Creek (Nebraska)						260,100							179,600	346,100	785,800	
Indian Creek (Iowa)													41,800	278,800	320,600	
Nishnabotna River						4,000,000							2,470,000	4,800,900	11,270,900	2
Nemaha River and tributaries						3,516,800		[1] 95,900						789,900	4,402,600	1
Tarkio River and tributaries						634,200		[1] 8,300					300	53,800	696,600	
Nodaway River and tributaries						2,844,000		[1] 109,600						1,026,100	3,979,700	
Republican River and tributaries						10,063,100		[1] 1,157,000						2,907,400	14,127,500	14
Solomon River						709,500		2,800						4,300	716,600	
Little Blue and Big Blue Rivers						2,505,100		44,500					5,700	627,700	3,183,000	
Kansas River and minor tributaries						1,864,500		[1] 13,100						60,300	1,937,900	
Blue River and tributaries								[1] 23,900					1,100	55,100	80,100	1
Fishing River and tributaries						616,000		[1] 26,400					10,000	532,900	1,185,300	
Grand River and tributaries						19,979,300		[1] 162,500					24,200	3,561,500	23,727,500	
Chariton River						8,317,400		[1] 91,300					200	525,700	8,934,600	
Lamine River						676,200		[1] 3,500						5,200	684,900	
Osage River and tributaries						2,344,700		[1] 26,800					24,000	169,500	2,565,000	
Gasconade River						845,300		[1] 67,900						59,600	972,800	
Missouri River	15,600		5,700		44,200	44,044,100		[1] 1,252,400	132,100	9,200	19,900	300	1,312,900	17,092,500	63,928,900	
Total	51,400		144,500		118,400	112,200,900	63,800	3,289,100	229,400	13,000	316,100	8,800	6,456,600	40,283,800	163,175,800	18
Ohio Basin																
Allegheny River	712,900	312,000	541,300	1,035,400	344,400	45,000		2,000	17,000	1,000	168,000	41,300	349,000	750,000	4,319,300	1
Chestnut Creek (SW Virginia)	72,000		158,300		5,000						3,200		9,000		247,500	
Kentucky River	20,000	15,000		1,000		20,000	5,000	500	10,000	4,000		1,500	13,000		90,000	
Blue River and Brock Creek (Indiana)														500,000	500,000	
Wabash River						308,000				6,000	1,000			2,000	317,000	
Cumberland River	97,100		234,000		8,500	260,500			106,500			19,000	15,000		740,600	2
Small streams in area of Green County, Tennessee	1,800	500	5,000	13,000		1,500,000			2,000		1,000	2,000	5,400		1,530,700	2
Tennessee River and tributaries	600		200								500		300		1,600	
Ohio River	700					62,500			100				2,400		65,700	
Total	905,100	327,500	938,800	1,049,400	357,900	2,196,000	5,000	2,500	135,600	11,000	173,700	63,800	394,100	1,252,000	7,812,400	5
Arkansas Basin																
Small mountain streams in Pueblo and Huerfano Counties, Colorado	65,000		15,000								145,000				225,000	
Fountain Creek														[3] 100,000	100,000	1
Ninnescah and Chikaskia Rivers								1,000	5,000		216,500				222,500	
Walnut River						11,000			6,000		26,000	20,000			63,000	
Cimarron River						14,000					6,000				20,000	
Verdigris and Caney Rivers			500		1,000	114,000			19,000		12,500		5,700		152,700	
Neosho River						46,600		500	17,500		21,700		23,000		109,300	
Canadian River						15,000					350,000		15,000		380,000	
Arkansas River						104,500			3,500		30,000		13,000		151,000	
Total	65,000		15,500		1,000	305,100		1,500	51,000		807,700	20,000	56,700	100,000	1,423,500	1
Red Basin																
Little River						[3] 1,214,000		2,500	199,000		18,000				1,433,500	
Sulphur River						5,000		1,000	1,000				5,000		12,000	
Total						1,219,000		3,500	200,000		18,000		5,000		1,445,500	

Lower Mississippi Basin																
Yazoo and Tallahatchie Rivers						90,000							200,000	410,000	700,000	
Mississippi River (Lower)	2,000		12,500		5,700	1,405,300	6,000	1,600	14,600	1,700	67,300	500	338,100		1,855,300	1
Total	2,000		12,500		5,700	1,495,300	6,000	1,600	14,600	1,700	67,300	500	538,100	410,000	2,555,300	1
WEST GULF OF MEXICO DRAINAGE																
Nezpique River											20,000				20,000	
Sabine River														300,000	300,000	
Trinity River						700		3,100			5,000		300		9,100	
Guadalupe River							900								900	
Total						700	900	3,100			25,000		300	300,000	330,000	
GULF OF CALIFORNIA DRAINAGE																
Colorado River											3,000				3,000	
PACIFIC SLOPE DRAINAGE																
Columbia Basin																
Flathead River						15,000			8,500		2,500		1,000		27,000	
Kootenai River						55,000					5,000				60,000	
Potlatch River											1,000				1,000	
Total						70,000			8,500		8,500		1,000		88,000	
Grand Total	2,323,600	407,200	2,465,100	1,418,700	2,700,600	160,558,100	237,700	3,479,600	1,652,600	147,000	5,372,800	264,200	15,056,200	76,244,700	272,328,100	55

[1] Includes movable farm propertyy.
[2] Damage to bridges and urban property.
[3] Includes all crop losses.

CLIMATOLOGICAL DATA FOR SEPTEMBER 1949

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	73.4	−3.2	Dayton	97	18	2 stations	35	30	3.31	+0.02	Spring Hill	9.98	Hayneville	0.14
Arizona	74.9	+2.5	Gila Bend	115	1 2	Maverick	28	1 16	1.62	+.30	Tonto Creek Fish Hatchery.	5.94	2 stations	.00
Arkansas	69.1	−5.1	2 stations	99	1 7	Batesville Livestock	28	30	3.20	−.09	Rogers	9.06	Marianna	.60
California	71.4	+1.9	do	118	1 1	Boca	20	7	.09	−.31	Betts Ranch	1.92	334 stations	.00
Colorado	59.2	+1.0	do	96	1 16	2 stations	13	1 19	.85	−.49	Wolf Creek Pass	3.96	Las Animas	.00
Florida	79.8	+1.4	do	98	1 17	Milton Exp. Sta	46	30	7.60	+.81	St. Augustine	20.89	Eglin Field	1.15
Georgia	73.6	−2.2	Lumber City	100	19	Blairsville Exp. Sta	31	30	3.26	−.53	Brunswick	15.51	Pearson	.30
Idaho	60.0	+2.7	2 stations	100	1	2 stations	13	17	.89	−.09	Wallace	3.58	2 stations	T
Illinois	61.6	−6.1	Mt. Vernon	95	3	do	26	29	2.76	−.88	Chester	7.52	Kewanee	.18
Indiana	61.0	−6.1	3 stations	90	1 3	Plymouth Power Substation.	25	30	2.64	−.64	Shelbyville Power Plant.	5.99	Delphia	.64
Iowa	59.2	−.5	2 stations	91	1 3	Saratoga, 2 E	16	29	3.21	−.80	Lemars	8.43	Bellvue L&D	.93
Kansas	65.3	−4.4	do	97	20	Burr Oak	28	1 28	2.22	−.54	Anthony	7.22	2 stations	T
Kentucky	64.5	−5.8	4 stations	91	1 4	3 stations	30	30	1.84	−1.03	Owensboro Dam 46	5.79	Wolf Creek Dam	.82
Louisiana	76.8	−1.1	2 stations	100	1 6	Tallulah Delta Lab	35	30	3.94	−.14	Burrwood	15.73	Grand Coteau	.12
Maryland-Delaware	64.7	−3.0	do	93	1 5	2 stations	28	25	3.29	−.06	Ridgely	6.49	Picardy	1.57
Michigan	56.6	−3.3	do	89	1 4	Watersmeet, U. S. Forest.	18	29	2.78	−.59	Rock	5.42	Rudyard	1.21
Minnesota	55.8	−3.2	Beardsley	91	2	Roseau Power Plant	20	28	1.74	−1.10	Tyler	4.64	2 stations	.40
Mississippi	74.0	−1.9	2 stations	97	1 7	2 stations	35	30	3.77	+.67	McHenry	15.42	Thyatira	.00
Missouri	63.1	−6.3	Camdenton	99	4	Bethany	27	1 29	4.78	+.78	Westphalia	10.16	Albany	1.86
Montana	55.8	+.2	Wolf Point, 4 ESE	96	24	Wibaux, 2 E	7	13	1.02	−.32	Livingston CAA AP	3.67	2 stations	.00
Nebraska	61.2	−3.3	Big Springs	99	16	Niobrara	24	29	2.19	+.09	Hartington	6.23	Kimball	.19
Nevada	65.4	+3.4	Overton	111	1	Wilkins	15	17	.27	−.15	Desert Game Range	1.95	16 stations	.00
New England	58.4	−1.9	3 stations, Mass	88	5	Chelsea, Vt	23	26	4.28	+.54	Tuckerman Ravine, N. H.	9.48	Block Island, R. I.	1.53
New Jersey	63.8	−2.2	Paterson	90	6	Charlotteburg	31	26	4.20	+.47	Macopin Intake	7.33	2 stations	1.67
New Mexico	66.5	+1.2	2 stations	102	1 1	Gavilan	20	18	2.44	+.59	Lovington	8.28	Aztec Ruins	.18
New York	58.5	−2.7	Cairo	91	5	4 stations	27	26	3.64	+.16	Cold Brook	8.73	West Jasper	1.40
North Carolina	68.9	−2.1	Mount Gilead	94	15	Mt. Mitchell	27	1 24	4.02	−.14	Monroe	9.78	Alta Pass	.85
North Dakota	55.6	−1.2	4 stations	94	1 10	Medora	13	13	.56	−.97	Sharon	1.29	Watford City	.12
Ohio	60.8	−4.8	Ironton	91	4	Batavia, 4 N	28	30	2.71	−.21	Steubenville Water Works.	5.04	New Lexington, 1 N	.72
Oklahoma	69.4	−4.7	Wagoner	101	7	Pawhuska	31	29	3.87	+.72	Atoka	9.80	Hooker	.29
Oregon	60.5	+1.8	Illahe, 1 N	105	3	Seneca	9	13	1.03	−.16	Timberline Lodge	5.14	Nyssa	.01
Pennsylvania	59.9	−4.2	3 stations	92	1 2	2 stations	25	1 10	3.15	−.24	Ralston	6.86	Austinburg, 2 W	1.37
South Carolina	72.1	−2.6	do	96	1 17	do	36	30	3.93	−.21	Conway	8.50	Beaufort	.48
South Dakota	58.3	−3.3	Wood	99	16	Hardy R. S	9	13	1.57	+.02	Vermillion	7.38	Longvalley	.26
Tennessee	66.9	−4.5	Clarksville	94	17	Waynesboro	29	30	2.00	−1.16	Watts Bar Dam	5.45	Portland	.18
Texas	75.8	−1.5	2 stations	104	1 1	Sulphur Springs	39	30	2.80	−.19	Port Isabel	14.15	Thornton	T
Utah	63.6	+2.5	Zion Nat'l. Park	106	1	Woodruff	16	19	.77	−.25	Alton	3.02	2 stations	T
Virginia	65.1	−3.4	4 stations	91	1 5	Burke's Garden	29	25	2.83	−.40	Appomattox	5.44	Darwin	.89
Washington	60.6	+2.0	Ruff, 3 SW	104	2	Bumping Lake	20	20	1.38	−.40	Mt. Baker Lodge	7.61	Yakima W. B. Airport.	.16
West Virginia	61.7	−4.5	2 stations	92	1 5	Cranberry Glades	22	24	2.62	−.35	2 stations	5.89	Brushy Run	.75
Wisconsin	56.3	−4.0	do	87	1 2	Coddington Exp. Farm.	10	29	2.01	−1.65	South Pelican	5.45	Wisconsin Rapids	.47
Wyoming	55.8	+1.0	Lower Crazy Woman	97	9	Bondurant	9	18	.90	−.30	Quaking Aspen Creek	2.55	Leo, 6 SW	.08
Alaska (Aug.)	52.2	−.4	Caswell	90	3	Shishmaref	21	28	3.22	−.29	Annex Creek	16.02	Fort Yukon	.06
Hawaii	73.5	−1.1	Puunene Airport	94	1 11	Haleakala R. S	39	1 6	2.54	−3.23	Kukui	18.00	17 stations	.00
Puerto Rico	78.7	−.8	2 stations	97	1 7	Utuado	53	27	11.64	+3.33	Rio Blanco (1800' elev.)	25.14	Ramey Field	2.38

1 Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR SEPTEMBER 1949

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Extremes: Highest	Date	Lowest	Date	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity [6]	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Speed of fastest mile: Miles per hour	Direction	Date	Character of day (sunrise to sunset) number of days: Clear	Partly cloudy	Cloudy	Sky cover,[7] tenths (sunrise to sunset)	Possible sunshine
NEW ENGLAND	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°F.	°F.	°F.	°F.	°F.		°F.			°F.	%	*In.*	*In.*	*In.*			*In.*	*In.*	*m.p.h.*					*0-3*	*4-7*	*8-10*	*0-10*	%
Caribou [3]	628	5	33	993.2	1,016.0	----	63	44	58.4 53.4	−.1 +.9	79	4	28	11	352	47	77 80	4.43 4.40	+.9 +.8	1.60	15	1	.0	0	11.9	----	38	nnw.	10	4	7	19	6.3 7.5	---
Eastport	75	67	82	1,013.9	1,016.6	−.3	63	51	56.9	+1.1	72	6	41	26	238	----	----	6.10	+3.3	2.47	14	5	T	0	8.2	----	32	e.	9	7	6	17	6.8	49
Portland, Maine [3]	103	6	43	1,012.5	1,016.7	−.9	68	47	57.2	−.7	81	19	30	26	239	62	83	6.27	+3.2	3.04	11	2	.0	0	5.0	----	27	se.	14	9	10	11	6.0	56
Concord [3]	289	5	45	1,006.8	1,017.2	−.8	69	46	57.8	−.2	84	4	31	26	234	51	79	4.75	+1.3	1.39	15	6	.0	0	4.4	----	23	w.	6	7	10	13	6.3	45
Mt. Washington	6,274	5	37	808.7	1,022.0	----	44	33	38.8	−2.2	58	4	20	26	789	----	----	8.02	+.4	1.77	20	1	7.8	0	30.4	----	----	----	----	3	5	22	8.0	26
Burlington [3]	403	6	51	1,001.7	1,016.4	−.5	68	50	59.2	−1.1	84	4	33	26	197	51	77	2.64	−.8	.68	16	2	.0	0	8.5	----	32	s.	27	5	8	17	7.2	30
Boston [3]	124	33	62	1,012.9	1,017.3	−.3	71	55	63.2	.0	85	5	44	25	104	53	72	6.47	+3.3	2.16	11	4	.0	0	10.9	----	33	sw.	1	9	10	11	5.7	62
Nantucket [3]	12	4	34	1,016.9	1,017.5	−.1	70	59	62.6	−.2	76	6	39	26	102	57	80	3.53	+1.1	1.22	9	2	.0	0	11.7	----	31	ne.	28	9	8	13	5.9	52
Block Island	26	11	46	1,016.6	1,017.6	.0	69	58	63.8	+.4	79	14	48	26	78	----	----	1.53	−1.1	.18	12	2	.0	0	14.7	----	57	nw.	9	9	11	10	5.6	60
Providence [3]	159	65	60	1,011.9	1,017.6	.0	73	54	63.6	+.4	85	4	39	26	100	54	76	3.42	+.2	.94	11	2	.0	0	8.0	----	34	sw.	18	13	5	12	5.5	65
Hartford [3]	159	5	44	1,011.9	1,017.8	−.2	73	51	61.8	+.1	84	14	37	26	132	53	75	3.03	−.5	1.28	15	1	.0	0	6.7	----	26	s.	9	7	13	10	6.1	63
New Haven [3]	107	5	39	1,013.2	1,017.8	−.2	72	54	62.7	+.9	82	19	40	26	108	55	72	2.95	−.3	1.02	12	2	.0	0	7.3	----	22	e.	12	9	11	10	5.4	67
MIDDLE ATLANTIC									65.0	−1.8							74	3.10	−.1														5.7	
Albany [3]	97	6	40	1,013.5	1,017.1	−.5	70	47	58.6	−2.6	84	4	33	26	208	51	77	2.10	−.7	.49	14	2	.0	0	7.4	----	36	nw.	20	9	7	14	6.3	54
Binghamton [4]	871	57	79	987.5	1,018.2	−.1	69	49	58.8	−2.5	84	4	36	26	200	50	82	3.33	+.2	1.03	15	4	.0	0	5.3	----	26	sw.	1	6	7	17	6.7	49
New York [4]	314	415	454	1,007.1	1,018.2	+.2	73	58	65.7	−1.1	84	5	48	24	53	54	68	2.92	−.5	.68	13	4	.0	0	11.1	----	42	nw.	9	9	10	11	5.6	61
Allentown [3]	385	4	58	1,004.4	1,018.6	----	73	51	62.0	−2.8	89	5	40	25	129	53	76	5.04	+1.6	2.93	12	3	.0	0	7.0	----	----	----	----	9	10	11	5.5	---
Harrisburg [3]	374	30	49	1,005.1	1,018.5	+.2	72	53	62.6	−3.2	88	5	41	26	116	52	72	1.61	−1.4	.44	13	2	.0	0	6.0	----	31	w.	23	9	6	15	6.0	59
Philadelphia [4]	114	174	150	1,017.3	1,018.2	−.1	74	59	66.6	−1.4	86	5	49	24	46	55	72	3.63	+.5	.98	13	2	.0	0	8.5	----	21	s.	18	10	10	10	5.2	63
Reading	323	47	306	1,006.4	1,018.3	.0	74	54	64.2	−2.4	88	5	43	26	93	----	----	3.27	+.1	1.40	12	3	.0	0	9.4	----	40	sw.	5	11	8	11	5.2	65
Scranton	805	72	104	989.5	1,018.3	.0	70	51	60.4	−2.5	85	5	40	26	166	----	----	3.19	.0	1.11	11	3	T	0	5.8	----	28	nw.	9	10	10	10	5.3	55
Atlantic City	52	37	172	1,015.9	1,017.6	−.4	72	60	66.0	−.8	85	6	49	25	57	----	----	1.67	−1.0	.51	8	0	.0	0	14.4	----	38	ne.	12	7	12	11	5.7	65
Newark [3]	30	5	46	1,016.9	1,017.8	----	75	55	65.0	−1.5	89	5	43	26	72	54	71	3.06	−.7	.90	13	4	.0	0	9.8	----	30	nnw.	8	10	10	10	5.7	---
Trenton	190	89	107	1,010.5	1,017.3	−.7	73	56	64.2	−2.7	85	5	45	26	84	----	----	4.19	+1.0	1.67	12	3	.0	0	8.5	----	27	w.	9	11	8	11	5.6	65
Baltimore [4]	123	100	215	1,014.2	1,018.7	+.7	76	59	67.2	−1.3	90	5	48	25	47	55	70	2.33	−1.0	.54	13	2	.0	0	9.0	----	35	w.	5	11	12	7	4.8	70
Washington [4]	112	56	100	1,014.6	1,018.6	+.6	77	58	67.1	−1.0	90	5	46	26	55	55	69	3.55	+.3	1.13	11	3	.0	0	9.4	----	34	nw.	23	10	10	10	5.6	65
Cape Henry	18	8	54	1,016.9	1,017.6	.0	76	67	71.5	−.3	90	19	55	25	9	----	----	4.67	+1.8	1.52	12	5	.0	0	13.6	----	40	ne.	12	8	11	11	5.6	73
Lynchburg [3]	686	5	58	985.1	1,018.7	+.1	75	56	65.2	−2.7	85	19	42	24	85	56	77	2.68	−.6	.82	10	5	.0	0	7.4	----	29	s.	18	9	9	12	5.5	69
Norfolk [4]	91	80	125	1,014.9	1,018.1	+.3	78	66	71.9	+.3	90	6	55	30	12	61	75	2.06	−1.2	.88	11	4	.0	0	10.7	----	34	ne.	12	6	11	13	6.2	69
Richmond [4]	144	11	52	1,012.5	1,018.3	.0	78	59	68.2	−2.3	87	6	47	25	36	59	80	3.46	+.2	1.08	9	4	.0	0	6.3	----	24	w.	18	8	10	12	5.9	68
EAST GULF																																		
New Orleans C. O.	53	76	84	1,013.2	----	----	86	72	79.0	−.2	93	8	58	30	0	----	----	7.10	+2.1	3.35	12	6	.0	0	6.7	----	20	se.	4	6	14	10	6.0	48
New Orleans A. P. [3]	30	6	52	1,013.2	1,015.2	−.4	86	71	78.7	----	94	8	60	30	0	69	77	5.19	----	2.17	10	5	.0	0	8.9	ene.	40	se.	4	6	10	14	6.0	---
WEST GULF									78.0	.0							71	3.29	−.4														5.2	
Shreveport [3]	181	5	64	1,007.1	1,016.1	+.2	86	64	75.4	−1.9	96	7	46	30	9	65	74	3.74	+.9	1.71	10	3	.0	0	7.7	ne.	32	s.	8	15	10	5	4.1	76
Fort Smith [3]	463	6	30	1,000.3	1,016.5	+.9	82	58	70.2	−3.8	95	5	41	29	35	57	68	3.75	+.8	1.25	10	5	.0	0	7.4	ene.	52	ne.	12	10	11	9	5.0	76
Little Rock [3]	265	26	58	1,004.7	1,017.7	+1.4	80	60	70.1	−4.0	91	4	45	30	27	59	72	2.75	−.4	1.02	7	3	.0	0	6.2	ne.	34	ne.	18	12	6	12	5.0	60
Austin [3]	621	5	41	993.6	1,015.0	+.4	90	68	79.4	+1.1	97	7	53	30	0	66	68	3.77	+.4	3.65	3	4	.0	0	7.6	ne.	36	se.	18	8	16	6	4.9	73
Brownsville [3]	20	5	54	1,011.2	1,012.4	−.1	90	75	82.3	+1.7	94	16	70	30	0	74	79	7.40	+1.6	5.21	12	7	.0	0	9.7	se.	33	ne.	30	9	14	7	5.6	49
Corpus Christi [3]	44	6	33	1,012.5	1,013.9	.0	90	73	81.5	+2.9	95	28	66	30	0	73	79	5.16	+.7	2.38	7	9	.0	0	8.8	sse.	32	ne.	23	9	9	12	5.9	75
Dallas [3]	488	34	45	998.0	1,015.7	+.5	86	65	75.6	−1.8	98	7	48	29	5	60	62	1.82	−.9	.81	7	4	.0	0	7.7	ne.	30	ne.	19	13	11	6	4.3	71
Forth Worth [3]	706	40	56	991.5	1,015.9	+1.0	86	65	75.4	−.5	99	12	51	29	6	60	63	3.13	+.6	2.21	6	2	.0	0	12.5	e.	31	n.	7	13	10	7	4.4	---
Galveston [4]	54	122	129	1,013.9	1,014.5	−.4	85	76	80.6	+.5	91	13	62	30	0	73	78	1.21	−4.4	.36	1	13	.0	0	12.9	se.	37	nw.	1	6	16	8	5.7	70
Houston [4]	138	157	190	978.0	1,014.5	−.4	88	72	80.4	+1.4	95	8	56	30	0	71	78	3.44	−.6	.96	10	10	.0	0	8.3	nne.	26	se.	17	3	15	12	6.2	56
Laredo [3]	418	10	38	997.6	1,012.7	----	95	74	84.5	+2.3	101	12	65	25	----	----	64	1.86	−1.4	.89	6	9	.0	0	12.3	se.	----	----	----	5	16	9	5.9	---
Palestine	510	64	72	997.6	----	----	86	66	76.2	−.8	95	7	48	30	5	----	----	4.20	+1.3	2.24	8	4	.0	0	6.1	ne.	27	ne.	1	14	10	6	4.4	82
Port Aurthur [4]	34	59	134	1,013.5	1,014.5	−.4	87	73	80.0	+.5	92	14	55	30	1	70	82	3.08	−1.7	1.07	7	8	.0	0	5.4	ne.	33	ne.	21	7	15	8	5.6	62
San Antonio [3]	794	6	51	989.8	1,014.4	+.2	91	70	80.8	+1.8	97	8	58	30	0	64	62	.78	−2.3	.31	4	1	.0	0	8.9	ne.	27	e.	18	4	19	7	5.7	72
OHIO VALLEY AND TENNESSEE																																		
Lexington [3]	989	4	58	983.4	1,019.3	+1.0	75	53	64.0	−4.5	86	4	36	30	98	52	71	1.32	−1.8	.53	6	4	.0	0	7.8	sse.	----	----	----	10	11	9	5.0	---
Louisville [3]	525	5	54	1,000.7	1,018.6	+.6	77	52	64.6	−4.4	88	4	33	30	93	52	68	.91	−1.9	.28	8	2	.0	0	5.8	sse.	32	w.	19	8	13	9	5.3	67
Evansville [3]	431	6	40	1,003.4	1,019.0	+1.7	76	51	63.4	−4.3	87	4	33	30	112	53	74	2.36	−1.0	1.01	8	6	.0	0	7.1	nnw.	26	sw.	5	13	8	9	4.9	73
Indianapolis [3]	823	5	54	989.2	1,018.8	+1.2	72	49	60.6	−4.8	84	3	35	30	155	50	72	2.52	−.9	.86	9	5	.0	0	8.4	se.	32	w.	19	11	7	12	5.2	70
Terre Haute [3]	575	4	36	997.6	1,018.6	+1.3	74	49	61.4	−6.9	83	3	34	30	138	51	72	2.78	−.8	1.40	8	5	.0	0	7.9	sse.	31	sw.	4	11	12	7	4.5	71
Cincinnati [4]	627	135	148	996.3	1,019.1	+1.1	74	55	64.4	−4.6	85	3	40	30	86	52	72	1.53	−1.1	.48	8	3	.0	0	7.6	ssw.	23	w.	22	9	12	9	5.3	60
Columbus [4]	822	90	110	989.2	1,019.2	+1.2	72	53	62.3	−4.2	84	3	40	30	130	51	73	2.86	+.3	1.56	10	7	.0	0	7.4	nw.	32	sw.	19	7	12	11	5.5	62
Dayton [3]	1,003	6	55	982.7	1,019.2	+1.6	70	50	59.8	−6.1	82	3	36	30	182	50	73	3.31	+.4	1.12	9	6	.0	0	9.1	s.	39	nw.	22	9	11	10	5.6	61
Elkins [3]	1,947	5	45	948.5	1,019.7	+.4	70	46	58.1	−3.8	83	17	31	25	220	51	83	3.00	−.2	.73	14	3	.0	0	5.6	----	45	w.	18	3	11	16	7.0	51
Parkersburg	637	77	84	----	----	----	74	52	62.8	−4.5	85	5	36	30	127	----	----	1.39	−1.4	.53	7	4	.0	0	5.9	----	22	nw.	18	10	10	10	5.5	61
Pittsburgh [3]	842	39	54	973.6	1,018.8	+.5	71	52	61.0	−3.7	82	3	39	30	149	60	70	1.80	−.8	.64	7	2	.0	0	9.2	----	30	sw.	19	8	10	12	5.9	50
LOWER LAKES																																		
									59.6	−2.7							74	3.22	+.2														6.0	
Buffalo [3]	768	34	96	988.8	1,017.4	+.1	68	50	58.8	−2.8	85	4	39	25	206	50	74	3.10	+.2	.98	13	5	T	0	12.5	----	45	w	1	6	8	16	6.7	52
Canton	448	10	61	999.7	1,015.6	−1.0	63	49	57.6	−1.2	82	4	35	25	237	49	74	3.80	+.4	1.27	15	1	.0	0	6.9	----	38	w	1	4	9	17	7.3	39
Oswego	335	71	85	1,004.4	1,016.6	−.7	67	53	59.9	−1.6	83	4	47	30	172	----	----	2.96	+.2	.74	15	3	.0	0	8.7	----	26	w	1	8	5	17	6.5	49
Rochester [3]	523	4	69	998.0	1,017.2	−.4	69	48	58.8	−3.6	86	4	35	25	209	50	77	2.77	+.3	.76	15	2	.0	0	9.2	----	59	sw	5	7	12	11	6.1	62
Syracuse [3]	596	5	57	995.3	1,017.4	−.6	70	50	60.0	−.3	86	5	40	11	180	51	75	4.38	+1.7	1.16	14	2	.0	0	7.5	----	42	w	1	7	6	17	6.7	58
Erie [4]	714	57	81	----	----	----	69	54	61.4	−2.2	84	4	44	30	147	----	----	4.24	+.8	.99	15	10	T	0	8.4	----	26	w	1	7	10	13	5.9	44
Cleveland [3]	762	27	54	990.5	1,018.4	+.4	71	50	60.0	−3.8	84	3	38	30	180	50	71	2.87	−.5	1.19	12	5	T	0	10.8	s	36	w	19	8	12	10	5.4	63
Sandusky	629	5	67	995.3	----	----	72	53	62.2	−3.1	86	3	39	30	120	----	----	3.60	+.6	1.43	9	4	.0	0	7.7	----	34	sw	5	8	13	9	5.2	71
Toledo [2]	628	5	47	995.3	1,018.4	+.4	70	48	59.0	−4.1	85	3	35	30	203	50	74	2.83	+.1	1.27	10	6	T	0	8.6	sw	32	sw.	4	6	14	10	5.6	72
Fort Wayne [3]	857	5	34	988.2	1,018.6	+1.0	70	48	58.7	−4.4	83	3	35	30	202	49	73	2.98	−.1	1.99	10	6	.0	0	7.0	s.	26	s.	4	8	10	12	5.6	62
Detroit [3]	730	5	77	991.5	1,018.2	+.2	69	50	59.6	−2.8	83	4	38	29	182	48	70	1.90	−1.0	.93	8	2	.0	0	10.5	s.	35	nw.	22	8	12	10	5.1	65

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR SEPTEMBER 1949—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Mean minimum	Mean	Departure from normal	Extremes: Highest	Date	Lowest	Date	Total heating degree days	Mean temperature of the dew-point	Mean relative humidity [4]	Precipitation: Total	Departure from normal	Greatest in 24 hours	Days with 0.01 inch or more	Days with thunderstorms	Total snowfall (unmelted)	Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Prevailing direction	Speed of fastest mile: Miles per hour	Direction	Date	Character of day (sunrise to sunset) number of days: Clear	Partly cloudy	Cloudy	Sky cover,[7] tenths (sunrise to sunset)	Possible sunshine
UPPER LAKES	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°F.	°F.	°F.	°F.	°F.		°F.			°F.	%	*In.*	*In.*	*In.*			*In.*	*In.*	*m. p.h.*					*0–3*	*4–7*	*8–10*	*0–10*	%
									56.7	−2.5							72	2.21	−1.1																
Alpena	609	5	89	993.2			66	48	56.8	−.8	87	4	37	29	260			2.27	−.7	.65	11	5	.0	0	10.3		34	w.	5	8	11	11	5.9	58
Escanaba	612	51	72	992.6			63	46	54.9	−2.2	77	18	31	29	305			1.60	−1.7	.47	14	0	T	0	10.7		34	n.	5	8	10	12	6.1	43
Grand Rapids [4]	707	70	244	992.2	1,017.5	+2	68	51	59.7	−3.0	85	4	35	29	184	47	73	1.88	−1.6	.82	11	2	.0	0	10.2	ssw.	47	nw.	22	10	8	12	5.4	59
Lansing [4]	878	5	90	985.4	1,017.8	+.2	67	47	57.2	−4.5	85	4	32	29	247	46	71	1.91	−1.0	.89	11	1	.0	0	13.1	ssw.	43	w.	22	13	4	13	5.3	57
Marquette	734	44	73	986.8			64	47	55.3	−2.2	82	2	34	29	299			4.97	+1.7	1.90	13	3	T	0	9.1		25	sw.	1	6	9	15	6.9	48
Sault Sainte Marie [2]	614	10	52	987.5	1,014.6	−2.3	62	44	53.2	−.8	78	3	29	29	355	46	80	3.09	−.4	1.32	13	3	.0	0	8.7	nw.	38	sw.	2	3	13	14	7.0	---
Chicago [2]	673	5	38	995.6	1,018.0	+.7	71	49	60.4	−4.5	85	3	38	30	160	47	65	1.24	−2.0	.57	9	2	.0	0	9.2	s.	36	n.	22	12	6	12	5.2	65
Green Bay	617	5	32	993.2	1,016.0	−.3	67	45	56.0	−4.4	79	2	24	29	276	45	69	1.25	−2.3	.49	8	1	.0	0	12.0	ssw.	45	sw.	26	10	7	13	5.6	65
Milwaukee [2]	681	33	66	991.5	1,017.1	+.2	68	49	58.6	−2.4	81	3	34	29	203	47	69	1.88	−1.4	.66	8	2	T	0	12.3	sw.	41	sw.	22	10	7	13	5.3	51
Duluth [4]	1,133	5	47	962.8	1,014.6	−1.0	64	46	54.6	−.5	83	9	34	28	315	44	76	1.99	−1.3	1.44	6	1	.0	0	15.6	w.	33	w.	18	9	13	8	5.1	54
NORTH DAKOTA																																		
									56.2	−.8							58	.45	−1.1														5.2	
Fargo [2]	940	5	47	980.0	1,014.6	−.3	70	44	56.8	−1.4	86	24	26	28	262	40	56	.36	−1.9	.23	5	0	.0	0	12.7	w.	44	w.	18	11	6	13	5.5	54
Bismarck [2]	1,677	5	41	955.3	1,015.0	+.1	72	41	56.4	−.9	92	16	24	28	272	40	60	.54	−.7	.27	5	1	.0	0	9.6	nw.	47	nw.	18	12	8	10	5.1	71
Devils Lake	1,478	11	44	960.7			68	42	55.2	−.7	87	25	28	28	301			.55	−1.1	.45	5	1	.0	0	8.4		34	w.	18	14	6	10	4.7	68
Williston	1,878	42	50	947.5			71	41	56.2	−.4	89	10	26	14	277			.36	−.7	.28	5	0	.0	0	6.9		36	w.	17	10	7	13	5.4	83
UPPER MISSISSIPPI																																		
									60.6	−4.6							70	1.95	−1.7														4.9	
Minneapolis-St. Paul [3]	919	43	74	981.7	1,015.2	.0	69	48	58.4	−3.0	84	3	34	29	211	46	67	2.67	−.5	1.33	6	1	.0	0	10.1	w.	36	w.	18	10	10	10	5.2	63
La Crosse [2]	672	5	29	991.5	1,016.2	+.3	70	45	57.6	−3.8	85	2	23	29	247	46	69	.94	−3.0	.29	6	2	.0	0	9.3	sse.	30	w.	18	7	10	13	5.8	68
Madison [2]	974	27	39	985.8	1,017.4	+.8	68	45	56.8	−4.6	80	18	25	29	256	46	70	1.12	−2.6	.56	10	1	.0	0	11.7	w.	36	s.	2	11	6	13	5.4	60
Charles City	1,015	10	51	981.4	1,018.3	+2.0	70	46	58.0	−3.0	82	2	28	29	222			1.63	−2.1	1.05	8	2	.0	0	6.3		20	nw.	18	17	6	7	3.9	66
Moline [2]	606	6	50	995.9	1,018.4	+1.5	71	47	59.0	−4.9	82	4	30	29	204	48	69	1.96	−1.6	1.54	6	2	.0	0	7.1	w.	28	sw.	4	14	4	12	4.7	64
Des Moines [4]	860	5	99	982.7	1,017.9	+2.0	73	49	60.8	−4.8	86	20	33	29	136	48	72	1.97	−1.7	.98	7	3	.0	0	8.9	s.	29	s.	20	16	3	11	4.3	89
Dubuque	699	60	79	991.9	1,017.3	+.7	69	49	59.2	−4.8	80	18	33	29	190	48	74	1.09	−2.9	.42	8	3	.0	0	5.0		16	nw.	13	13	5	12	5.0	66
Burlington [3]	702	4	36	992.9	1,018.6	+1.7	73	47	60.1	−6.3	86	3	34	29	182	48	74	1.39	−3.1	.98	7	3	.0	0	10.9	s.	36	nw.	19	13	5	12	4.8	68
Cairo	357	5	99	1,005.4			77	58	67.4	−5.1	89	17	42	30	53			1.64	−1.2	.85	6	3	.0	0	7.1		24	w.	17	13	6	11	5.0	78
Peoria [2]	609	7	26	995.9	1,018.4	+1.1	72	49	60.4	−5.5	87	3	32	29	168	47	67	1.62	−2.4	.80	5	4	.0	0	10.0	s.	32	nw.	19	13	6	11	4.9	67
Springfield, Ill. [4]	636	5	49	996.3	1,018.4	+1.8	74	53	63.6	−4.0	87	3	38	29	96	50	71	2.60	−1.0	1.89	8	5	.0	0	9.1	s.	34	nw.	19	12	7	11	4.9	74
St. Louis [4]	568	33	59	998.0	1,018.2	+.9	74	57	65.6	−4.9	88	4	44	29	70	52	71	4.77	+1.3	3.05	8	3	.0	0	6.6	se.	40	s.	12	12	8	10	4.8	69
MISSOURI VALLEY																																		
									61.8	−4.2							70	3.91	+.8														4.9	
Columbia, Mo. [4]	784	6	66	989.5	1,018.0	+1.4	74	52	62.8	−6.6	85	20	38	29	112	53	80	6.37	+2.0	2.17	9	6	.0	0	7.2	sse.	24	nw.	13	12	7	11	5.0	65
Kansas City [2]	963	38	76	990.5	1,017.7	+2.1	75	54	64.4	−4.5	87	20	38	29	79	50	66	4.37	+.6	2.87	9	4	.0	0	6.9	s.	36	nw.	12	11	7	12	5.0	71
St. Joseph [2]	967	5	51	982.7	1,017.6	+2.0	75	50	62.6	−5.8	88	20	35	29	106	40	72	5.00	+1.1	3.35	10	7	.0	0	8.8	s.	43	sw.	4	14	7	9	4.9	63
Springfield, Mo. [3]	1,324	5	50	972.6	1,018.1	+1.5	74	54	63.9	−4.5	89	12	38	29	106	52	76	5.59	+2.1	2.16	8	5	.0	0	8.0	sse.	42	w.	6	9	10	11	5.2	62
Topeka [4]	987	65	87	985.8	1,017.7	+1.8	76	53	64.7	−4.0	90	20	37	29	79	52	72	1.79	−2.0	1.16	8	9	.0	0	8.0	s.	26	nw.	12	11	7	12	5.4	58
Lincoln [4]	1,189	6	81	974.3	1,017.0	+2.1	74	51	62.2	−4.2	90	20	33	29	122	48	72	4.51	+1.5	2.23	5	6	.0	0	7.5	s.	31	s.	20	12	7	11	5.1	70
Norfolk, Nebr. [3]	1,551	5	38	961.7	1,016.6		73	47	60.2	−3.8	90	20	28	29	179	46	68	2.41	−.5	1.02	7	7	.0	0							14	7	9	4.3	---
Omaha [2]	1,105	5	68	981.7	1,017.2	+.6	73	49	61.4	−4.3	88	20	32	29	137	49	70	3.17	.0	1.62	6	7	.0	0	9.5	sse.	36	nw.	12	12	8	10	4.6	68
Valentine	2,598	46	54	924.5	1,015.9	+.7	74	45	59.7	−2.8	96	16	28	28	190	41	54	1.49	+.2	.55	9	8	T	T	8.2		33	n.	26	15	5	10	4.7	75
Sioux City [2]	1,138	5	40	975.6	1,016.7	+1.5	74	46	59.8	−2.7	89	20	29	29	180	48	72	5.99	+3.0	2.80	8	7	T	T	8.7	s.	32	nw.	18	14	5	11	4.6	75
Huron [2]	1,301	5	41	969.2	1,015.4	+.2	72	45	58.4	−2.9	88	16	26	28	215	44	66	2.34	+.8	1.05	8	4	.0	0	10.6	s.	42	nw.	18	12	9	9	4.7	61
NORTHERN SLOPE																																		
									57.5	+0.7							52	1.01	−.2														5.2	
Billings [2]	3,570	16	39	892.3	1,015.3	−.6	72	45	58.6	−1.6	87	24	31	12	203	39	54	2.26	----	.71	10	2	T	0	9.5	sw.	61	nw.	16	9	8	13	5.5	60
Butte	5,533	44	58	831.7	1,018.5	----	68	35	51.4	−.3	81	23	25	12	409	35	60	1.69	+.8	.64	9	2	1.4	0	7.6	s.	----	----	----	----	----	----	5.4	---
Glasgow	2,086	34	53	940.7	1,015.1	----	74	41	57.5	+.2	91	9	21	13	240	33	44	.36	−.7	.18	6	1	T	0	----	----	----	----	----	----	12	5	13	5.2	---
Great Falls [3]	3,657	16	75	889.6	1,015.6	----	71	46	58.4	+.5	88	23	29	12	214	35	47	.52	−.9	.24	6	0	2.0	0	10.4	sw.	68	w.	16	10	9	11	5.4	76
Havre	2,507	11	67	926.9	1,015.9	+1.0	74	42	58.0	+1.6	90	1	27	13	211	----	----	.14	−1.2	.07	4	1	T	0	7.6	w.	43	sw.	16	10	12	8	5.1	74
Helena [3]	4,124	5	43	875.4	1,017.1	+1.9	70	40	55.0	−.4	87	1	22	12	301	38	52	1.08	−.2	.70	5	3	7.5	0	6.4	w.	43	w.	16	10	10	10	5.3	68
Missoula [2]	3,263	4	32	902.1	1,016.2	−.1	73	42	57.6	+4.1	90	1	29	12	225	38	54	1.33	+.1	.84	10	5	T	0	6.0	se.	34	w.	16	9	11	10	5.7	68
Kalispell	2,973	48	56	913.0	1,015.7	+.8	69	42	55.5	+2.0	84	1	28	12	286	39	----	.97	−.3	.72	4	0	.7	0	10.2	nne.	----	----	----	----	11	7	12	5.9	---
Miles City [2]	2,371	5	28	931.6	1,015.5	−.1	75	44	59.2	----	91	24	28	13	193	35	----	.37	----	.21	8	1	T	0	8.9	wnw.	----	----	----	----	12	7	11	5.0	---
Rapid City [2]	3,259	5	56	902.1	1,015.1	−.5	74	45	59.7	−.5	95	16	29	13	184	37	52	1.05	−.2	.55	6	4	T	T	13.6	sse.	50	nw.	16	11	12	7	4.9	72
Cheyenne [3]	6,094	22	40	813.8	1,014.3	−.3	72	43	57.8	+.8	85	16	33	13	218	36	52	.25	−1.0	.10	7	5	.0	0	9.9	w.	34	nw.	11	10	9	11	5.4	73
Lander [3]	5,352	6	30	830.7	1,014.9	.0	74	43	58.5	+2.8	86	2	32	13	198	34	42	.63	−.3	.42	5	7	T	T	6.4		43	sw.	16	16	7	7	3.9	69
Sheridan [3]	3,790	5	38	885.5	1,016.1	+.5	74	41	57.4	+1.1	89	24	30	13	233	36	52	1.48	+.2	.97	8	2	1.0	1	6.5	nw.	56	w.	16	11	9	10	5.0	70
North Platte [3]	2,821	11	51	917.4	1,015.4	+.2	76	45	60.9	−1.2	93	16	30	13	156	45	66	1.97	+.6	1.11	6	5	.0	0	9.6	s.	38	sw.	30	13	9	8	4.7	68
MIDDLE SLOPE																																		
									66.1	−2.7							62	2.04	−.2														4.8	
Denver [4]	5,292	106	113	838.5	1,014.0	−.6	77	51	64.0	+1.1	91	16	44	13	76	37	48	.08	−.9	.06	3	3	.0	0	7.2	s.	27	w.	11	12	10	8	4.7	71
Pueblo [3]	4,690	5	36	857.8	1,013.6	−.3	82	50	65.7	+1.1	93	6	42	28	43	42	52	.38	−.4	.22	4	7	.0	0	5.9	nw.	41	n.	3	14	10	6	4.0	78
Concordia	1,392	50	58	967.8	1,017.3	+2.1	75	52	63.8	−4.5	90	20	37	29	96	48	62	1.77	−.8	.66	9	8	.0	0	7.9		28	n.	20	11	10	9	4.9	58
Dodge City [3]	2,509	5	58	931.3	1,015.6	+.7	78	54	65.6	−3.8	90	20	42	29	69	51	68	.55	−1.4	.26	6	6	.0	0	13.0	s.	40	sw.	30	14	3	13	5.1	67
Wichita [3]	1,358	52	64	968.8	1,016.6	+1.7	77	55	66.2	−4.4	88	12	41	29	59	52	69	3.62	+.5	1.53	11	9	T	T	13.5	s.	45	nw.	12	11	12	7	4.9	65
Oklahoma City [4]	1,214	10	47	970.2	1,016.4	+1.2	80	59	69.8	−3.0	95	7	43	29	38	57	68	3.35	+.3	1.22	7	6	.0	0	12.0	sse.	20	s.	17	14	10	6	4.5	60
Tulsa [3]	674	10	60	992.6	1,017.0	----	79	56	67.8	−5.1	95	12	40	29	58	56	70	4.53	+1.5	2.11	7	6	.0	0	8.1	s.	36	s.	12	11	8	11	5.2	60
SOUTHERN SLOPE																																		
									73.4	−.5							65	3.08	+.5														4.6	
Abilene [3]	1,755	4	59	954.6	1,014.7	+.5	86	63	74.7	+.9	98	12	47	24	6	59	64	1.39	−1.3	1.20	5	3	.0	0	10.8	s.	36	n.	13	14	6	10	4.9	70
Amarillo [3]	3,604	5	42	890.6	1,014.7	+.2	81	56	68.2	+.4	92	12	47	14	31	54	65	1.69	−.6	.90	11	4	.0	0	10.9	s.	42	s.	30	14	6	10	4.6	69
Del Rio	960	63	71	980.0	1,013.0	+.1	90	70	79.9	+.7	97	8	61	25	0	66	67	5.58	+2.6	3.20	6	7	.0	0	7.5	e.	22	e.	21	11	16	3	4.4	73
Roswell [3]	3,614	6	29	892.7	1,013.9	+.4	84	58	70.8	+.5	95	12	45	25	7	56	65	1.87	−.2	.73	6	8	.0	0	6.9	s.	33	ne.	1	13	7	10	4.7	62
Wichita Falls [3]	1,030	4	49	979.3	1,015.6	----	84	62	73.2	−4.9	100	12	50	29	17	59	64	4.89	+2.1	2.03	6	2	.0	0	11.1	se.	40	ne.	13	14	7	9	4.6	---

See footnotes at end of table.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS FOR SEPTEMBER 1949—Continued

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean Maximum	Temperature of the air: Averages: Mean Minimum	Temperature of the air: Averages: Mean	Temperature of the air: Averages: Departure from normal	Temperature of the air: Extremes: Highest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Lowest	Temperature of the air: Extremes: Date	Total heating degree days	Mean temperature of the dew point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Greatest in 24 hours	Precipitation: Days with 0.01 inch or more	Precipitation: Days with thunderstorms	Precipitation: Total snowfall (unmelted)	Precipitation: Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Wind: Prevailing direction	Wind: Speed of fastest mile: Miles per hour	Wind: Speed of fastest mile: Direction	Wind: Speed of fastest mile: Date	Character of day (sunrise to sunset) Number of days: Clear	Character of day (sunrise to sunset) Number of days: Partly cloudy	Character of day (sunrise to sunset) Number of days: Cloudy	Sky cover,[7] tenths (sunrise to sunset)	Possible sunshine
SOUTHERN PLATEAU	*Ft.*	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°F.	°F.	°F.	°F.	°F.		°F.			°F.	%	*In.*	*In.*	*In.*			*In.*	*In.*	*m. p.h.*					*0-3*	*4-7*	*8-10*	*0-10*	%
El Paso [2]	3,916	35	85	886.6	1,012.0	+.8	86	63	78.1 74.7	+3.3 +2.4	92	18	58	14	0	57	48 55	1.30 1.74	+.5 +.5	.57	9	9	.0	0	8.5	se.	45	sw.	2	14	9	7	3.5 4.6	70
Albuquerque [2]	5,314	5	45	850.0	1,011.9	.0	85	59	71.8	+3.9	94	3	52	14	6	48	49	.87	+.5	.44	5	7	.0	0	7.8	se.	42	se.	4	17	9	4	3.6	76
Flagstaff	6,907	34	48	794.1	1,016.5	+4.3	77	45	60.8	+3.6	86	1	33	30	132	41	57	3.47	+1.8	1.41	15	12	T	0	5.4	nnw.				13	8	9	4.7	
Phoenix [4]	1,107	39	87	970.5	1,008.3	+.2	100	74	87.0	+4.3	108	1	66	30	0	60	45	.89	+.1	.57	5	9	.0	0	5.0	e.	33	ne.	22	19	7	4	2.8	85
Tuscon [2]	2,555	5	39	922.5	1,009.5	+1.0	94	70	82.2	+2.5	103	1	66	29	0	56	46	.81	−.4	.30	5	13	.0	0	7.6	se.	35	ne.	28	14	11	5	3.9	80
Yuma	142	9	54	1,002.0	1,007.1	−.7	105	79	92.2		112	22	73	27	0	60	39	T		T	0	2	.0	0	6.2	se.	25	sw.	6	25	5	0	1.5	98
MIDDLE PLATEAU									63.3	+3.6							41	.62	.0														2.7	
Ely [2]	6,262	8	41	810.4			79	39	59.0	+6.6	90	1	27	18	183			.36	−.3	.22	2	4	.0	0	11.1		54	s.	25	21	5	4	2.4	88
Reno [2]	4,527	26	52	861.8	1,013.3	+.1	82	40	60.9	+2.9	92	1	32	18	139	36	44	.18	−.1	.18	2	0	.0	0	5.5	s.	34	nw.	27	24	6	0	1.6	90
Winnemucca	4,339	5	56	867.3			83	41	62.0	+2.8	98	1	26	18	126			.21	−.2	.21	2	2	.0	0	7.4					21	8	1	2.3	88
Salt Lake City [2]	4,357	32	58	871.0	1,012.8	−.4	82	52	67.1	+4.4	91	6	36	18	58	38	39	.64	−.3	.47	7	7	T	0	9.8	sse.	36	se.	9	17	5	8	3.5	81
Grand Junction [2]	4,602	5	26	860.1	1,013.5	.0	83	52	67.6	+1.4	90	6	44	14	31	38	40	1.72	+.8	1.02	6	8	T	T	8.4	e.	45	nw.	1	14	13	3	3.5	76
NORTHERN PLATEAU									62.2	+2.6							49	.76	−.2														4.9	
Baker [4]	3,471	36	54	895.4	1,015.7	−.6	77	44	60.4	+4.4	93	1	28	12	164	37		.43	−.3	.22	4	2	.0	0	6.0	n.	24	sw.	8	13	14	3	4.2	79
Meacham	4,056	7	28	877.8	1,016.8		70	45	57.4		87	1	30	12	240	39	55	2.01		.96	8	2	T	0	5.7	wnw.				10	10	10	5.2	
Boise [2]	2,739	5	49	918.7	1,013.3	−1.3	81	50	65.6	+4.4	93	1	34	12	90	37	38	.19	−.3	.14	3	2	.0	0	10.0	nw.	35	s.	9	10	17	3	4.0	86
Lewiston	1,436	4	23	963.4	1,014.5		79	50	64.6		97	1	37	12	94	43	51	1.31		.81	8	2	.0	0	6.0	e.				9	11	10	5.4	
Pocatello [2]	4,478	5	31	863.2	1,014.6	+.4	78	44	61.1	+1.8	88	1	26	13	130	33	38	.07	−.7	.07	1	4	.0	0	7.3	s.	41	sw.	16	17	10	3	3.4	79
Ellensburg [2]	1,735	5	58	953.6	1,015.6		75	45	60.2	+2.2	91	1	32	20	172	43	58	.61	+.1	.36	2	1	.0	0	9.3	nw.				10	12	8	4.9	
Spokane [2]	1,929	6	51	947.2	1,015.7	+.8	74	49	61.6	+2.4	93	1	35	12	155	40	49	1.06	+.2	.64	5	1	.0	0	8.2	ne.	37	sw.	16	7	12	11	5.8	65
Walla Walla	991	57	65	979.0	1,015.6	+.7	78	54	65.9	+2.1	95	1	41	12	64	44		.96	−.0	.69	7	2	.0	0	4.0	s.	21	sw.	16	7	10	13	6.1	54
Yakima [2]	1,076	4	54	976.0	1,014.8	+.4	81	45	63.0	+1.2	100	1	32	17	127	44	55	.16	−.4	.13	3	0	.0	0	7.9	w.				12	10	8	4.7	
NORTH PACIFIC COAST									61.5	+2.6							68	1.29	−.7														5.7	
Kelso [2]	750	38	76				75	47	61.2		89	3	33	12	147	51	75	1.44		.54	6	2	.0	0	5.9	n.				9	9	12	6.0	
North Head	211	5	55	1,008.5	1,015.9	−.7	64	53	58.6	+2.1	90	26	48	20	201			1.77	−1.2	.62	10	2	.0	0	10.7	n.	56	s.	15	6	8	16	7.1	42
Seattle [4]	125	90	321	1,011.5	1,016.0	−.6	71	54	62.6	+2.3	86	6	46	20	112	51	73	1.30	−.5	.88	5	1	.0	0	7.4	nnw.	35	s.	16	8	8	14	6.1	55
Tacoma	194	172	201	1,009.1	1,015.9	−.7	69	52	60.4	+3.1	81	6	44	20	157			1.41	−.7	.83	6	0	T	0	7.0	n.	30	w.	16	7	12	11	5.9	54
Tatoosh Island	86	5	61	1,013.2	1,016.2	−.4	60	50	55.0	+2.0	80	4	45	25	299	51	87	2.37	−2.3	1.03	8	1	.0	0	11.5	s.	56	ne.	27	4	9	17	7.3	40
Burns	4,162	35	47	873.7	1,014.8		77	42	59.6	+4.0	89	22	25	17	187	33	41	.15	−.7	.09	3	2	.0	0						16	10	4	3.2	
Eugene [2]	433	4	35	1,002.4	1,015.8		76	47	61.8		96	3	36	20	119	51	73	.73		.28	6	2	.0	0	7.1	n.				11	6	13	5.6	
Medford [2]	1,329	29	58	967.5	1,014.8	+.2	82	49	65.6	+2.1	98	3	37	17	43	47	59	.54	−.1	.24	7	4	.0	0	6.5	nw.				15	7	8	3.9	
Portland, Oreg. [4]	154	68	106	1,010.2	1,015.7	−.2	76	56	65.8	+4.1	91	27	47	20	60	52	73	1.23	−.8	.72	8	4	.0	0	4.6	nw.	20	w.	16	9	9	12	5.9	55
Roseburg	510	45	76	996.6	1,015.6	−.3	77	52	64.4	+1.5	96	3	42	21	62	52	63	1.96	+.7	1.33	6	2	.0	0	3.9	n.	24	sw.	8	11	7	12	5.6	47
MIDDLE PACIFIC COAST									66.7	+1.9							55	.13	−.5														3.5	
Eureka	60	72	88	1,013.9			62	51	56.6	+.7	70	28	46	21	254			.50	−.5	.27	7	1	.0	0	5.6		21	n.	16	6	9	15	7.0	52
Red Bluff [2]	353	5	26	998.6	1,011.1		91	60	75.6	+2.5	108	2	52	26	2	44	36	T	−.8	T	0	1	.0	0	6.9	se.	30	nw.	24	24	6	0	1.4	94
Sacramento [4]	66	92	115	1,009.1	1,011.6	−.3	87	58	72.2	+2.9	102	22	52	25	3	51	54	.03	−.4	.03	1	2	.0	0	10.9	sw.	21	sw.	8	25	5	0	1.1	95
San Francisco [4]	155	112	132	1,012.5	1,013.2	−.3	70	55	62.4	+1.5	89	22	51	24	106	53	76	T	−.4	T	0	0	.0	0	13.9	nw.	26	w.	16	12	11	7	4.5	62
SOUTH PACIFIC COAST									72.7	+3.0							66	T	−.2														2.1	
Fresno [2]	327	5	34	999.7	1,011.3	+.1	93	57	75.2	+3.2	105	23	48	26	1	50	46	.00	−.2	.00	0	0	.0	0	6.2	nw.	22	nw.	8	29	1	0	.5	99
Los Angeles [4]	338	236	263	1,007.8	1,011.6	−.6	84	62	72.9	+3.9	103	7	55	27	0	58	76	.01	−.2	.01	1	0	.0	0	5.2	w.	20	w.	6	23	7	0	2.1	84
San Diego [2]	87	20	55	1,008.5	1,011.5	−.4	77	63	70.0	+1.8	92	7	55	27	1	60	75	T	−.1	T	0	0	.0	0	6.0	wnw.	19	w.	27	17	9	4	3.8	67
ALASKA																																			
Anchorage [3]	132	6	44	1,002.4	1,007.5		58	42	49.8	+2.0	72	3	34	29	460	44	78	2.45	−.1	.55	16	1	.0	0		nw.	28	se.	5	0	4	26	9.2	
Annette Island	113	5	53	1,010.5	1,014.6		61	49	55.2	+1.3	77	4	42	27	300	50	82	11.57	+2.1	3.42	16	0	.0	0	11.1	se.				9	1	20	7.0	
Barrow	29	5	27	1,012.5	1,013.2		36	32	34.2	+3.4	52	10	28	30	930	32	96	.58	+.1	.34	4	0	1.1	0	12.5	ene.	26	se.	11	0	0	30	9.8	
Bethel [3]	28	5	31	1,002.0	1,003.4		54	42	47.7	+2.5	66	1	34	27	519	44	96	2.80	−.2	.47	23	0	T	0	10.4	se.	32	sse.	3	0	0	30	9.5	
Cordova [3]	45	5	32	1,007.5	1,009.1		57	41	48.8	+1.0	65	8	30	29	485	46	88	22.19	+6.0	7.60	25	0	.0	0	5.7	e.	36	se.	26	2	2	26	8.9	
Fairbanks [3]	455	5	63	989.8	1,006.8		61	35	48.2	+4.6	74	3	23	30	499	42	76	.12	−1.2	.06	4	0	.0	0		nnw	27	sw.	27	2	7	21	8.0	
Galena	139	4	66	1,000.7	1,005.4		55	41	47.6	+5.0	67	1	27	29	521	42	77	.64	−.9	.10	14	0	.0	0	9.1	n.				1	2	27	8.6	
Juneau [3]	80	6	30	1,012.9	1,013.5		58	44	50.8	+2.2	72	5	35	10	426	46	84	7.80	+1.2	2.30	20	0	.0	0		n.	26	e.	25	3	3	24	8.5	
Kotzebue [3]	20	5	31	1,006.1	1,006.8		52	41	46.6	+6.0	61	2	33	22	552	42	85	1.07	+.2	.28	13	0	.0	0		ese.				1	6	23	8.4	
McGrath [3]	341	5	31	992.9	1,005.4		56	39	47.8	+3.9	76	3	25	28	517	42	80	1.29	−1.1	.26	16	0	.0	0	4.5	wnw				2	5	23	8.4	
Nome [3]	22	10	75	1,004.1	1,004.7		52	41	46.4	+4.7	62	15	32	25	553	43	86	4.14	+1.4	.90	22	0	.0	0	12.4	se.	42	e.	29	0	3	27	9.2	
Northway [3]	1,718	5	32	946.5	1,009.5		58	36	46.8	+4.4	70	1	25	23	548	38	74	.52	−.9	.15	9	0	T	0	5.2	se.				1	5	24	8.8	
St. Paul Is.	28	4	39	1,000.3	1,001.7		48	40	44.4	−.8	52	5	31	22	616	43	91	5.00	+1.5	1.50	20	0	.0	0						0	3	27	9.3	
Yakutat	31	5	50	1,011.2	1,012.5		56	44	49.8	+1.1	65	4	35	9	455	46	88	18.94	+3.1	2.61	22	0	.0	0		wsw				2	1	27	8.9	
HAWAII																																			
Honolulu [4]	38	86	98	1,016.3	1,016.6		82	73	77.3	−.9	84	2	70	4	0			.54	−.7	.28	11	0	.0	0	13.5		25	ne.	10	5	21	4	5.3	71

[1] Height of barometer cistern above mean sea level on Jan. 1, 1900, or when station was first established since Jan. 1, 1900. When station is moved to new location or airport, the pressure is reduced to the original elevation for homogeneity. These elevations do not represent the present station elevation in most cases.

[2] Data are from airport records. Pressures adjusted to original elevations according to note 1.

[3] Barometric hygrometric, wind, character of day, and average cloudiness data from airport records; remainder from city office records.

[4] Barometric and hygrometric data from airport records, remainder from city office records.

[5] Barometric, temperature, degree day, and hygrometric data from airport; remainder from city office records.

[6] As of Jan. 1, 1949, relative humidity values at temperatures below 32° F. are expressed with respect to water rather than with respect to ice, as used prior to that date. Therefore, these hygrometric values before and after Jan. 1, 1949, cannot accurately be combined without necessary conversion.

[7] As of Jan. 1, 1949, "Sky cover" has been substituted for "Average cloudiness" to include smoke, snow, etc., in addition to clouds that obscure the sky.

NOTE.—Unless otherwise indicated, data in table are city office records.

REPORTS RECEIVED TOO LATE TO BE INCLUDED IN TABLES

District and station	Elevation of instruments: Barometer above sea level [1]	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station	Pressure: Sea level	Pressure: Departure from normal	Temperature of the air: Averages: Mean maximum	Temperature of the air: Averages: Mean minimum	Temperature of the air: Averages: Mean	Temperature of the air: Averages: Departure from normal	Temperature of the air: Extremes: Highest	Temperature of the air: Extremes: Date	Temperature of the air: Extremes: Lowest	Temperature of the air: Extremes: Date	Total heating degree days	Mean temperature of the dew point	Mean relative humidity [6]	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Greatest in 24 hours	Precipitation: Days with 0.01 inch or more	Precipitation: Days with thunderstorms	Precipitation: Total snowfall (unmelted)	Precipitation: Snow, sleet, and ice on ground at end of month	Wind: Average hourly speed	Wind: Prevailing direction	Wind: Speed of fastest mile: Miles per hour	Wind: Speed of fastest mile: Direction	Wind: Speed of fastest mile: Date	Character of day (sunrise to sunset) number of days: Clear	Character of day (sunrise to sunset) number of days: Partly cloudy	Character of day (sunrise to sunset) number of days: Cloudy	Sky cover [7] tenths (sunrise to sunset)	Possible sunshine
	Ft.	*Ft.*	*Ft.*	*Mb.*	*Mb.*	*Mb.*	°F.	°F.	°F.	°F.	°F.		°F.			°F.	%	*In.*	*In.*	*In.*			*In.*	*In.*	*m. p.h.*					*0–3*	*4–7*	*8–10*	*0–10*	%
SOUTH ATLANTIC									72.1	−.5							77	4.60	+.4														6.2		
Asheville	2,253	77	92	944.8	1,018.8	+.2	75	54	64.4	−.6	86	18	40	30	100	55	81	1.53	−1.5	.60	8	3	0.0	0	6.1	nw.	22	se.	26	10	7	13	5.6	69
Charlotte [4]	779	63	86	987.8	1,018.5	+.5	79	61	70.0	−1.5	90	17	45	30	28	59	73	2.36	−.6	1.18	11	0	.0	0	6.1	nne.	18	s.	22	7	10	13	6.2	57
Greensboro [2]	886	6	56	987.5	1,019.0	+.7	77	57	67.4	−2.4	86	18	43	30	52	58	76	2.22	−1.0	.54	9	3	.0	0	9.0	ne.	26	nw.	8	8	8	14	5.9	59
Hatteras	11	5	47	1,016.6	1,017.3	.0	78	70	74.0	−.5	85	18	61	25	1	68	82	7.24	+2.6	2.66	13	5	.0	0	11.5	s.	36	s.	20	4	9	17	7.1	80
Raleigh [4]	376	5	71	1,002.7	1,018.3	+.3	80	61	70.3	−.8	90	16	47	25	26	61	80	2.86	−.8	1.27	9	2	.0	0	6.2	ne.	17	nw.	18	9	9	12	5.7	49
Wilmington	72	73	107	1,016.6	1,017.6	.0	80	66	73.2	+.1	88	17	54	24	2	66	---	3.25	−1.3	.85	14	6	.0	0	8.4	ne.	31	nw.	13	3	11	16	7.1	53
Charleston [4]	48	11	92	1,014.9	1,016.8	−.1	81	70	75.4	−1.2	91	19	55	30	0	67	82	8.16	+3.6	5.76	9	4	.0	0	9.6	ne.	28	ne.	10	4	12	14	6.8	61
Columbia, S. C. [4]	347	70	91	1,009.5	1,017.6	.0	82	64	72.6	−1.9	93	17	46	30	12	63	75	2.63	−.8	1.32	8	3	.0	0	7.4	nne.	22	ne.	10	8	10	12	5.7	63
Greenville, S. C. [2]	1,040	18	36	981.0	1,018.2	+.6	78	60	68.8	−1.8	90	17	45	30	41	59	75	5.32	+1.6	2.35	8	4	.0	0	7.5	ne.	26	ne.	2	7	10	13	5.9	65
Augusta [2]	182	62	77	1,002.7	1,017.5	+.6	84	65	74.4	−.9	94	19	49	30	4	61	68	1.52	−1.9	.32	10	4	.0	0	8.2	ne.	---	-----	---	7	11	12	5.7	---
Savannah [2]	65	19	51	1,014.6	1,017.0	+.4	84	68	76.0	+1.7	93	19	54	30	1	68	79	6.67	+1.3	1.97	13	6	.0	0	9.2	n.	35	e.	16	6	15	9	6.9	44
Jacksonville [4]	43	86	110	1,015.2	1,016.5	+.2	86	72	79.1	+.8	94	7	60	20	0	72	80	11.42	+4.1	4.42	17	6	.0	0	7.7	ne.	23	e.	10	1	16	13	----	53
FLORIDA PENINSULA									81.7	+.7							79	9.22	+2.0														6.2		
Key West [4]	21	10	64	1013.5	1014.3	+.4	88	78	82.9	+.7	90	8	72	17	0	75	76	6.46	−.2	1.70	15	7	.0	0	9.2	e.	37	w.	29	5	18	7	5.6	69
Miami [4]	25	242	249	1013.5	1014.6	−.3	86	76	81.2	+.3	90	9	69	30	0	73	78	10.73	+2.1	4.48	17	11	.0	0	11.9	e.	43	se.	26	5	17	8	5.8	78
Tampa [2]	35	5	36	1013.9	1015.3	+.4	89	73	81.0	+1.1	94	9	69	13	0	73	82	10.47	+4.0	3.71	17	14	.0	0	5.7	e.	29	w.	22	2	13	15	7.2	48
EAST GULF									74.0	−.9							74	3.95	−.3														5.8		
Atlanta [2]	1,173	33	72	976.6	1,017.7	+.4	80	62	70.8	−2.0	91	18	44	30	23	60	72	2.91	−.1	1.96	9	3	.0	0	8.2	ene.	32	sw.	6	11	11	8	5.1	60
Macon [4]	370	79	87	1,004.4	1,017.2	+.3	83	64	73.5	−1.3	93	17	45	30	9	62	70	1.05	−2.1	.44	8	3	.0	0	6.0	ene.	32	n.	18	6	12	12	6.2	68
Apalachicola	35	11	51	1,014.6	1,015.9	+.3	84	72	78.3	−.2	92	8	57	30	0	---	---	4.70	−3.4	1.61	11	3	.0	0	8.3	ne.	26	se.	3	10	5	15	6.4	64
Pensacola [4]	56	54	79	1,013.9	1,016.0	+.1	84	72	78.0	.0	93	8	56	30	0	69	---	8.16	+2.8	2.71	10	8	.0	0	7.6	ne.	31	se.	4	7	9	14	6.4	66
Anniston	618	6	32	995.6	1,017.7	+.8	83	59	70.7	-----	90	15	39	30	21	61	75	1.20	−2.5	.50	7	2	.0	0	5.9	ene.	---	-----	---	13	9	8	5.7	---
Birmingham [2]	700	5	63	995.3	1,017.6	+.3	82	61	71.5	−1.7	90	17	39	30	25	60	72	4.31	+.9	2.10	7	3	.0	0	7.5	ene.	30	ne.	24	11	8	11	5.4	55
Mobile [4]	57	86	161	1,008.1	1,016.1	−.5	85	70	77.6	−.5	92	8	51	30	2	68	79	5.45	+.4	2.94	9	2	.0	0	8.7	n.	47	se.	4	8	11	11	6.0	56
Montgomery [4]	218	92	105	1,009.5	1,016.8	+.2	84	66	75.1	−1.2	92	17	48	30	5	63	72	.72	−2.3	.43	5	1	.0	0	6.8	n.	28	n.	28	10	11	9	5.4	64
Meridian [4]	375	67	92	1,003.4	1,016.9	+.4	85	63	74.1	−.4	92	17	43	29	12	64	77	5.87	+2.9	3.26	8	6	.0	0	5.7	ne.	---	-----	---	11	9	10	5.5	---
Vicksburg [4]	247	82	102	1,007.5	1,016.3	+.3	84	66	74.6	−1.7	91	18	49	30	10	64	---	.76	−2.1	.31	8	0	.0	0	7.8	e.	27	n.	28	5	18	7	5.5	69
New Orleans C. O.	53	76	84	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
New Orleans A. P. [3]	30	6	52	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
OHIO VALLEY AND TENNESSEE									63.8	−4.0							73	2.04	−1.0														5.3		
Chattanooga [2]	762	6	66	990.2	1,018.2	+.6	80	57	68.7	+.5	90	17	44	30	36	58	74	2.33	−.8	1.29	8	2	.0	0	3.8	n.	32	n.	18	11	9	10	5.2	55
Knoxville [2]	995	27	71	983.7	1,018.6	+.6	78	57	67.5	−1.9	89	17	41	30	50	58	75	2.38	−.3	.90	10	2	.0	0	6.0	ne.	35	n.	29	10	8	12	5.4	69
Memphis [2]	399	5	49	1,007.1	1,017.5	+.9	79	61	69.9	−3.7	87	3	45	30	29	58	69	1.42	−1.4	.45	7	2	.0	0	6.7	ne.	23	sw.	17	11	10	9	4.8	78
Nashville [2]	546	5	72	998.6	1,018.3	+.3	81	56	68.2	−3.6	91	17	36	30	43	56	70	.76	−2.7	.33	6	1	.0	0	6.0	n.	29	nw.	18	13	11	6	4.7	69
WEST INDIES																																		
San Juan, P. R.	82	9	54	1,011.2	1,013.9	-----	85	75	80.2	−.3	93	8	70	27	0	-----	---	5.97	+.1	1.78	21	10	.0	0	9.7	e.	41	e.	21	1	17	12	6.9	36

[1] Height of barometer cistern above mean sea level on Jan. 1, 1900, or when station was first established since Jan. 1, 1900. When station is moved to new location or airport, the pressure is reduced to the original elevation for homogeneity. These elevations do not represent the present station elevation in most cases.

[2] Data are from airport records. Pressures adjusted to original elevations according to note 1.

[3] Barometric, hygrometric, wind, character of day, and average cloudiness data from airport records; remainder from city office records. Reference on page 267.

[4] Barometric and hygrometric data from airport records, remainder from city office records.

[5] Barometric, temperature, degree day, and hygrometric data from airport: remainder from city office records.

[6] As of Jan. 1, 1949, relative humidity values at temperatures below 32° F. are expressed with respect to water rather than with respect to ice, as used prior to that date. Therefore, these hygrometric values before and after Jan. 1, 1949, cannot accurately be combined without necessary conversion.

[7] As of Jan. 1, 1949, "Sky cover" has been substituted for "Average cloudiness" to include smoke, snow, etc., in addition to clouds that obscure the sky.

NOTE.—Unless otherwise indicated, data in table are city office records.

SEVERE STORMS FOR SEPTEMBER 1949

[The table hereunder contains such data as have been received concerning severe storms that occurred during the month.]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Boston and suburbs and western portion of Essex County, Mass.	1	Early morning.				Rain and wind	Broken power and telephone lines; flooded cellars and streets; small washout on railroad lines.
New York, western, central, and northern portions.	1	All day		1		Wind	Cold front caused gusts up to 65 m. p. h. at Buffalo and 50 m. p. h. at Rochester. Trees, power and communication lines blown down. Pears and apples blown from trees, with heavy losses in Oswego area. Boy drowned at Piseco Lake.
Grand Junction and Palisade, Colo.	1	5:40-6:20 p. m.	[1] 3		$9,300	Wind, rain, and hail.	Wind, reaching a velocity of 60 m. p. h., and accompanied by heavy rain and light hail, swept through path 20 miles long from point northwest of Grand Junction to foothills east of Palisade. Damage mostly to picked peaches in orchards, although some losses from bruising and blowing from trees. Telephone and power lines damaged to some extent. A few small buildings wrecked.
Montrose, Colo.	1	7:30-8 p. m.			10,000	Hail	Damaged growing crops east of Montrose.
Louisiana, southeastern portion.	4	Morning			12,500	Tropical disturbance.	Developed in area of squalls as it moved inland. Lowest pressure at New Orleans 29.68 and at Grand Isle 29.76 inches. Highest wind at Grand Isle 42 m. p. h. from southeast. Tide at Grand Isle rose to 2 feet above average low water, with west end of island, including road to mainland, inundated. Beach was eroded and some beach cottages damaged. Sugarcane in Terrebonne Parish suffered some damage.
Mississippi, coastal section	4	Midday			12,500	do	Disturbance, which moved northeastward across southeastern Louisiana into southern Mississippi, resulted in winds of 45 to 50 m. p. h. on the coast at Bay St. Louis and Pass Christian. Several piers destroyed, and tung and pecan trees suffered some damage to nearly mature nuts.
Nogales, Ariz.	4	2 to 6 p. m.				Hail and wind	Fruit, corn, and bean crops badly damaged. Approximately 120 roofs damaged by hail, which reached "golf ball" size at times.
Newark (1 mile west of), Wirt County, W. Va.	4	6 p. m.	440	0	4,600	Tornado, with hail, rain and lightning.	Tornado moved northeastward with path about 1 mile long. Several buildings blown down, roofs blown off several other buildings. 1 cow killed by lightning. 1 person injured by heavy hail. Some damage by heavy rain to contents of buildings, roofs of which were blown off.
Nescopeck-Shickshinny area, Pa.	5	4-10 p. m.				Electrical, wind, rain, and hail.	Barn at Cope's Corners struck by lightning and burned, with heavy loss of crops and equipment. Hick's Ferry section suffered extensive crop damage from hail. Greyhound bus delayed about an hour by heavy rain and hail near Shickshinny. High winds tore down many trees, ripped off screens, and knocked down peaches and apples in orchards.
Muncy, Pa.	6	4-5 p. m.			$9,000	Electrical	Barn near Muncy struck by lightning and burned, with loss of stored crops, equipment, tools, and about 100 chickens.
Monroe, N. C.	7				250,000	Rain and flash flood.	Highest water stages in memory of city's oldest residents reached. City water system disrupted by flood.
St. George, Utah	8	3:30 p. m.			20,000	Thunderstorm and flash flood.	Storm lasted 25 minutes. Damage reported worst from a cloudburst in more than 20 years. Water poured from the Red Hills or north edge of town, bringing muddy, red water through business district and flooding main street and main floors and basements of business houses.
Calexico, Calif.	8	Afternoon			15,000	Wind, rain, and dust.	Southern and central parts of Imperial Valley received severe wind and dust storm, reported to have originated in Baja Calif. Wind accompanied by rain forced power lines down, lifted an airplane hangar over another hangar and deposited it 150 feet away, blew 2 airplanes into New River, caused damage to local airport totaling $15,000, uprooted trees, carried away haystacks, and caused interruptions of power and telephone communications. Storm lasted approximately half an hour.
Ash Fork, Ariz.	9	2:15-2:50 p. m.			25,000	Hail and wind	Nearly every house in Ash Fork suffered some damage. 2 airplanes at nearby field damaged by wind.
St. Augustine, Fla.	9	3-3:20 p. m.				Electrical, wind, and hail.	High wind and heavy hail, with stones of marble size, accompanied thunderstorm. No damage from hail. A few roofs damaged by wind. Lightning interrupted telephone service.
Nantucket Sound, Mass.	9	Late afternoon		9		Wind	Small cabin cruiser, carrying 11 persons, disabled and sunk almost immediately by sudden squall and moderate sea; about 2 miles northwest of Nantucket Harbor. 9 persons drowned.
West Palm Beach, Fla.	10	3 p. m.				Wind and rain	Wind in gusts up to 54 m. p. h. felled 6 feeder-line poles, leaving cities of Palm Beach and West Palm Beach without electric power for several hours. Rainfall for 45-minute period eading at 3:40 p. m. was 3.20 inches.
Glendale and Deer Valley, Ariz.	10	7 to 8 p. m.	[1] 2		100,000	Wind and hail	Many trees and poles down in Glendale. Roof blown off Halstead Lumber Co. Plate glass windows broken in several stores. Rear end of Smith Motor Co. building collapsed after wind blew in side door. Community cotton gin badly damaged by high wind. 1,500 telephones out of order. Hail up to 1¼ inches caused up to 30 percent damage to crops in path of storm, which was about 10 miles in length.
Gila Bend, Ariz.	10	Evening		4	13,500	Thunderstorms and flash floods.	Flash flood blocked Highway 80 about 10 miles north of Gila Bend. Stalled auto washed off highway when irrigation canal above road washed out, drowning 4 persons. Water flooded cotton fields, and washed levees and dams. High winds felled power and telephone lines.
Helena, Mont.	10-11					Snow	Unseasonably heavy snowstorm of 7.5 inches. Many shade trees which still bore summer foliage broken.
Linn County, Kans.	12	4:45 p. m.	400	1	$35,000	Tornado	Storm originated 6¼ miles east and 1½ miles south of LaCygne, travelled southeastward for about 3 miles and ended in Missouri. Funnel cloud observed northeast of LaCygne, as it dipped and rose. Several farm properties destroyed. Considerable crop damage.
Amsterdam, Mo.	12	5 p. m.	90-100	1	38,000	Tornado, hail, and rain.	Storm originated in Kansas and struck ground near Amsterdam, Mo. Path on ground 3½ miles long. Farm buildings demolished and crops in fields and in storage damaged by wind and rain. $8,000 crop damage included in total.
Salem, Mo.	12	9 p. m.				Rain	Local flooding caused considerable damage to stored goods, and to streets and roads.
Seventy-Six, Mo.	12	During night		3		do	3 crew members killed when their engine fell into a normally dry creek, due to rain-weakened trestle of Frisco Railroad Line ST & SF giving way.
Cape and Perry Counties, Mo.	12	During night				do	Considerable damage by local flooding. Heavy loss of crops in fields and soil. Construction work hampered, and loss to roads by washing away of gravel stock described as "staggering".
Salt River Valley in Phoenix area, Ariz.	13					Thundershowers and flash floods.	Flash floods from mountains surrounding Phoenix to north and west. Fields badly flooded in Tolleson-Deer Valley areas, necessitating reseeding of approximately 2,000 acres of winter vegetables. Secondary roads washed out in Pleasant Valley sector.
Friday Harbor, Wash.	15-16					Maritime disturbance.	Estimated wind of 50 m. p. h. did some damage to purse seine fishing fleet in San Juan Islands area. Fleet forced to seek shelter from long-continued southeast to southwest winds.

[1] Miles instead of yards.

SEVERE STORMS FOR SEPTEMBER 1949—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Idaho Falls (west of), Idaho	16	Afternoon				Wind and dust	Disruption of highway traffic, uprooting of trees, and scattering of debris resulted from high winds. 4 persons injured, requiring hospitalization. Clouds of dust necessitated rerouting traffic from main highway running northward to Montana.
Monroe, La	16	8 p. m			$80,000	Electrical	Lightning struck stored tanks of gasoline, setting fire to hangar; hangar 5 small airplanes, equipment, and accessories destroyed.
Great Falls, Mont	16–17					Wind	Gusts up to 68 m. p. h. by 12:30 p. m., 16th. No damage reported.
Labette County, Kans	18	12:25 a. m			200,000	do	High wind from northwest blew down trees, telephone and power lines, and unroofed buildings over much of county. Kansas Ordnance Plant east of Parsons hardest hit and several buildings collapsed.
Monroe County, Pa	18	6-10 p. m				Electrical, rain, and hail.	Hailstones more than 1 inch in diameter fell for 20 minutes in Brodheadsville area. Heavy rain in Stroudsburg area for over an hour, resulted in some local flooding. Power service interrupted by lightning hits, with street lights off for several hours in portions of Stroudsburg.
Lincoln, Penobscot, Waldo, and Washington Counties, Maine.	20					Hail	Light to moderate damage to greenhouses and late garden crops at scattered points. Hailstones varied in size from small shot to ¾ inch diameter.
Key West, Fla	23	4:13 p. m	25	0	0	Waterspout	Small waterspout first sighted about 1 mile east-northeast of Weather Bureau Airport Station, passed over station, and dissipated about ½ mile away.
Du Bois, Pa	24	12-1 p. m		2		Electrical	Lightning struck a school chimney then travelled out on wet grass to where a group of children were playing, killing 2 and stunning 4.
Jacksonville, Fla	24–25					Rain	Airport Station recorded rainfall of 10.13 inches in 24 hours. Streets flooded, but only minor damage. Greatest 24-hour amount at City Office was 4.42 inches.
St. Augustine, Fla	24–26					do	3.03 inches of rain in 24 hours ending at 8 a. m., 25th, 8.94 inches in next 24-hour period flooded streets and caused minor damage.
Alton, Utah	28	12 noon–1 p. m.				Thunderstorm and flash flood.	Hailstones 2 inches in diameter; roofs destroyed. Rain very heavy for an hour.
Letcher County, Ky	29	7–7:30 a. m				Hail and electrical	Neon, Camp Branch, and Sandlick bore brunt of storm. Store windows broken, roofs damaged, and late garden and field crops flattened. Light to heavy hail; stones ranged from ½ to ¾ inch in diameter.

DELAYED REPORT FOR AUGUST 1949

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Rupert, Pa	13	2-3 a. m.				Rain	Washout on Reading Railroad from heavy local rains that culverts unable to carry away.

SOLAR RADIATION DATA FOR SEPTEMBER 1949

Explanation of Tables 1 and 2 and references to descriptions of instruments, stations, and methods of observation, and to summaries of data, are given in the MONTHLY WEATHER REVIEW, vol. 72, No. 1, January 1944, p. 43. A list of pyrheliometric stations is given on page 45 of that issue. An explanation of the formula used in computing the air mass values for each station listed in Table 1 appears in vol. 75, No. 3, March 1947, p. 47.

TABLE 1.—*Solar radiation intensities during September 1949*

[Gram calories per minute per square centimeter of normal surface]

MADISON, WIS.

Date	Sun's zenith distance: A. M. 78.7°	75.7°	70.7°	60.0°	0.0°	P. M. 60.0°	70.7°	75.7°	78.7°	Vapor pressure: 7:30 a. m.[1]	1:30 p. m.[1]
	Air mass: 4.81	3.84	2.88	1.92	*0.96	1.92	2.88	3.84	4.81		
September										*mb.*	*mb.*
1	0.84	0.99	1.07	1.19	1.40	1.11				8.4	8.7
2	.76	.86	.98	1.16	1.38	1.14				8.7	9.8
8	.70	.83	.96	1.11	1.33	1.07				9.8	11.8
9	.62	.77	.90	1.11	1.36	1.07				9.4	12.3
10	.61	.75	.87	1.06						11.0	12.7
16	.59	.70	.83							11.4	12.3
19	.85	1.02	1.11	1.24						8.7	10.2
20	.79	.90	.95	1.15	1.41	1.10				7.8	10.2
23	.84	.96	1.07	1.22						7.8	8.7
24	.74	.92	1.06	1.19	1.37					6.4	7.8
26	.61	.74	.87	1.03	1.23	1.01				9.4	10.6
28			1.03	1.18						8.4	7.8
29	.90	1.03	1.15	1.33	1.48	1.26				3.7	4.8
30	.83	.92	1.04	1.21	1.45	1.21	1.04			5.6	5.6
Means	.74	.88	.99	1.17	1.38	1.12	1.04				
Departures	+.03	+.03	+.02	+.04	+.02	−.02	+.02				

TABLE MOUNTAIN, CALIF.

	Air mass: 3.76	3.01	2.26	1.51	*0.75	1.51	2.26	3.01	3.76		
September										*mb.*	*mb.*
6				1.42							
13	1.18	1.26	1.36	1.48							
17				1.46							
30				1.41							
Means	1.18	1.26	1.36	1.44							
Departures	+.03	+.03	+.03	+.04							

LINCOLN, NEBR.

	Air mass: 4.77	3.81	2.86	1.91	*0.95	1.91	2.86	3.81	4.77		
September										*mb.*	*mb.*
1				1.07	1.34	1.12	0.97			8.7	9.1
2			0.77	0.90	1.18					10.2	11.4
3					1.22	0.92	0.69			18.3	21.1
13		0.98	1.07	1.22	1.37	1.20	1.05	0.92	0.79	6.6	8.4
15				1.11	1.34	1.12	0.92			9.4	11.0
19		0.96	1.03	1.18	1.33	1.12	.88			8.7	8.1
23	0.81	.90	1.01	1.16	1.28	1.10	.90	.75		7.8	7.8
24	.69	.81	.94	1.09	1.30					8.4	10.2
Means	0.75	0.91	0.96	1.10	1.30	1.10	0.90	0.84	0.79		
Departures	+.02	+.07	−.01	−.04	−.09	−.05	−.07	+.01	+.07		

BOSTON, MASS.

	Air mass: 4.96	3.96	2.97	1.98	*0.99	1.98	2.97	3.96	4.96		
September										*mb.*	*mb.*
20			0.87	1.13						12.9	9.8
21			1.04	1.17						9.8	9.5
27		0.93	1.12	1.17						10.9	13.2
Means		0.98	1.01	1.16							
Departures		+.22	+.10	+.13							

BLUE HILL, MASS.

	Air mass: 4.86	3.89	2.92	1.94	*0.97	1.94	2.92	3.89	4.86		
September										*mb.*	*mb.*
2					1.42	1.24	1.08	0.95	0.86	8.8	9.3
3					1.30	1.15				11.3	12.5
4	0.70	0.80	0.93	1.10	1.27					13.3	14.6
6						1.17		.78	.68	18.3	15.0
10	.97	1.06	1.16	1.27	1.41	1.23	1.09	.96	.86	9.6	9.2
11	.92	1.02	1.14	1.28		1.25	1.06	.94	.82	12.3	12.3
12	.98	1.06	1.13							12.7	12.8
16	.50	.66		1.04		1.13	.99	.82		11.9	11.8
17	.64	.72	.90	1.11				.67	.49	11.4	12.2
19						.98	.80	.74	.66	23.0	18.2
20	.68	.83	.97	1.18						12.6	10.5
21			1.09	1.23						9.7	10.6
24								.93	.83	9.7	9.2
25	.91	1.00	1.15	1.27		1.28	1.13	1.01	.90	7.6	7.4
26	.88	.97	1.09	1.19		1.09	.98	.87	.76	7.6	10.5
27	.92	1.02	1.15							10.5	9.6
30							1.10	.98	.86	14.9	12.8
Means	0.81	0.91	1.07	1.19	1.35	1.17	1.03	.88	.77		
Departures	+.05	+.04	+.09	+.07	−.03	+.05	+.10	+.09	+.10		

RATIO, BOSTON/BLUE HILL ON COMPARABLE DATES

		0.96	0.94	0.96							

*Extrapolated.

[1] 75th Meridian Time.

TABLE 2.—*Daily totals and weekly means of solar radiation (direct+diffuse) received on a horizontal surface during September 1949*

[Gram-calories per square centimeter]

Date	Honolulu, T. H.	Pearl Harbor T. H.	La Jolla, Calif.	Riverside, Calif.	Nashville, Tenn.	Fresno, Calif.	Washington, D. C.	Columbia, Mo.	Soda Springs, Calif.	Seabrook, N. J.	Grand Lake, Colo.	New York, N. Y.	Salt Lake City, Utah	State College, Pa.	Lincoln, Nebr.	Newport, R. I.	Put-in-Bay, Ohio	E. Wareham, Mass.	Blue Hill, Mass.	Boston, Mass.	Lynn, Mass.	Twin Falls, Idaho	E. Lansing, Mich.	Madison, Wis.	Toronto, Canada	Summit, Mont.	Fairbanks, Alaska
Sept. 3	683	612	475	482	488	616	384	452	643	478	273	459	546	570	436	507	552	470	531	520	506	560	397	186	472	307	271
Sept. 4	482	616	455	509	527	611	491	424	676	466	458	479	527	420	357	554	381	536	568	540	522	378	337	202	431	136	....
Sept. 5	623	644	415	523	249	621	497	473	672	481	512	....	512	379	367	492	548	489	473	431	384	523	209	320	343	155	....
Sept. 6	624	583	536	527	566	625	432	91	677	396	441	....	541	491	135	373	570	312	435	433	478	547	269	171	318	317	203
Sept. 7	682	634	527	502	522	615	140	435	525	219	437	297	504	210	235	398	275	377	333	300	320	555	10	164	62	551	156
Sept. 8	564	494	520	463	407	601	403	399	460	331	445	101	341	424	391	278	562	320	394	341	397	541	371	530	194	533	264
Sept. 9	538	525	515	361	622	618	584	626	658	498	436	577	280	462	532	354	572	242	176	165	173	528	444	548	510	515	352
Means	599	587	492	481	483	615	419	414	616	410	429	383	464	422	370	422	494	392	416	390	397	519	291	303	333	359	249
Departures	−1	+21	+12	−14	+86	+49	+28	−64	+30	....	−15	+21	+11	+57	−66	−1	+65	−8	+30	+14	....	+18	−48	−76	−53	+27	+37
Sept. 10	488	458	499	466	518	600	573	552	630	552	433	564	343	572	61	580	547	549	597	562	454	522	405	463	444	82	240
Sept. 11	627	645	509	528	542	600	520	50	629	474	318	391	488	546	220	571	455	525	539	576	550	440	131	114	439	247	178
Sept. 12	477	387	502	536	497	571	381	38	494	306	635	432	559	377	71	574	360	526	562	540	468	553	150	98	402	492	203
Sept. 13	550	493	501	521	286	565	237	568	495	132	238	31	234	50	576	315	75	348	160	115	190	528	89	330	402	518	317
Sept. 14	573	547	466	503	548	543	272	155	573	359	622	220	524	321	302	408	377	334	273	216	195	518	205	378	387	346	181
Sept. 15	626	632	449	486	244	548	474	158	583	379	610	372	516	200	545	153	330	203	174	138	136	479	386	472	283	145	181
Sept. 16	663	548	284	479	118	575	266	321	592	292	585	266	516	386	497	417	394	408	514	481	490	232	361	380	395	96	154
Means	572	530	459	503	394	572	389	*263	571	356	491	325	454	350	324	431	363	413	403	376	368	468	247	319	343	275	208
Departures	−18	−27	+12	+33	+7	+39	+8	−153	−9	....	−1	−33	−13	−51	−94	+41	−24	+39	+31	+39	....	−4	−34	−26	−9	−45	+13
Sept. 17	597	560	261	446	438	569	494	265	596	486	569	478	530	484	90	479	394	476	511	469	446	533	348	117	419	171	131
Sept. 18	567	586	367	468	361	537	364	444	579	424	610	418	537	332	530	463	176	425	397	377	332	516	115	512	92	343	263
Sept. 19	640	588	116	444	512	507	436	591	575	424	590	472	504	376	524	330	417	215	382	368	354	498	202	403	304	293	272
Sept. 20	637	624	115	305	574	520	448	563	569	426	590	361	486	341	488	493	374	468	422	420	382	497	290	494	479	465	259
Sept. 21	643	618	176	451	566	513	508	461	544	514	485	463	500	488	468	495	238	498	470	392	392	498	143	447	69	413	120
Sept. 22	631	507	180	394	488	528	472	547	540	417	568	248	468	95	511	375	226	260	194	182	158	494	149	222	300	452	177
Sept. 23	620	591	424	455	554	498	383	568	540	346	477	254	440	232	497	139	331	136	82	70	66	469	247	299	248	446	224
Means	619	582	234	423	499	524	443	491	563	434	555	385	495	335	444	396	308	341	351	325	304	501	213	356	273	369	207
Departures	+22	+28	−157	−31	+112	+30	+78	+49	+22	....	+50	+54	+49	+3	+36	+41	−30	+15	00	+37	....	+73	−70	+2	+3	+32	+38
Sept. 24	605	567	279	447	555	510	448	549	570	427	472	337	336	340	496	465	391	408	359	344	345	268	276	469	329	393	74
Sept. 25	567	465	388	431	359	527	492	538	482	496	509	574	365	489	483	510	464	477	508	484	431	438	334	460	198	344	79
Sept. 26	474	522	442	469	500	495	481	523	441	456	322	430	402	482	362	488	474	464	469	434	441	443	349	443	376	389	67
Sept. 27	596	471	464	459	468	465	93	474	326	366	518	215	424	140	352	346	276	353	364	416	435	364	(242)	274	217	438	54
Sept. 28	617	579	446	453	420	468	282	(542)	446	366	527	211	341	232	496	79	157	55	50	455	35	271	198	274	145	427	174
Sept. 29	553	455	436	452	515	486	85	529	486	34	338	57	221	106	494	118	381	104	93	105	77	325	357	475	201	292	216
Sept. 30	639	601	400	433	550	466	464	532	515	450	257	412	304	466	433	218	461	199	255	278	314	309	364	445	396	64	178
Means	579	523	408	449	481	488	335	527	467	371	420	320	342	322	447	318	372	294	300	301	297	346	303	406	266	335	120
Departures	−16	−7	+30	+6	+126	+25	−9	+156	−6	....	−3	+8	−29	−19	+86	−21	+32	−49	−41	+2	....	−77	+25	+102	−42	+13	−14
ACCUMULATED DEPARTURES ON SEPT. 30, 1949																											
	+266	+413	−10255	....	+7056	+9793	−1232	.....	+917	....	....	....	−1029	+7021	−3465	+6013	+9107	+3259	+6531	+10255	....	+4256	−4263	+8526	−49	+644	....

NOTE.—Values in parentheses are interpolated.

TABLE 3.—*Daily totals and weekly means of solar and sky radiation plus the radiation reflected from the ground, as received on a vertical surface facing south at Blue Hill, Mass., during Sept. 1949*

Date	3	4	5	6	7	8	9	*Mean*	10	11	12	13	14	15	16	*Mean*	17	18	19	20	21	22	23	*Mean*
Gm cal cm^{-2}	344	376	312	281	196	249	115	*267*	412	395	400	80	172	102	413	*282*	413	303	310	344	376	115	51	*273*
Date	24	25	26	27	28	29	30	*Mean*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gm cal cm^{-2}	279	460	444	342	21	44	208	*257*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 4.—*Daily totals and weekly means of solar and sky radiation plus the radiation reflected from the ground, as received on a vertical surface facing north at Blue Hill, Mass., during Sept. 1949*

Date	3	4	5	6	7	8	9	*Mean*	10	11	12	13	14	15	16	*Mean*	17	18	19	20	21	22	23	*Mean*
Gm cal cm^{-2}	78	77	88	87	99	95	50	*82*	67	67	88	67	86	61	66	*72*	66	81	69	69	75	65	32	*65*
Date	24	25	26	27	28	29	30	*Mean*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gm cal cm^{-2}	76	64	58	71	20	45	62	*57*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

U. S. GOVERNMENT PRINTING OFFICE: 1949

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, September 1949

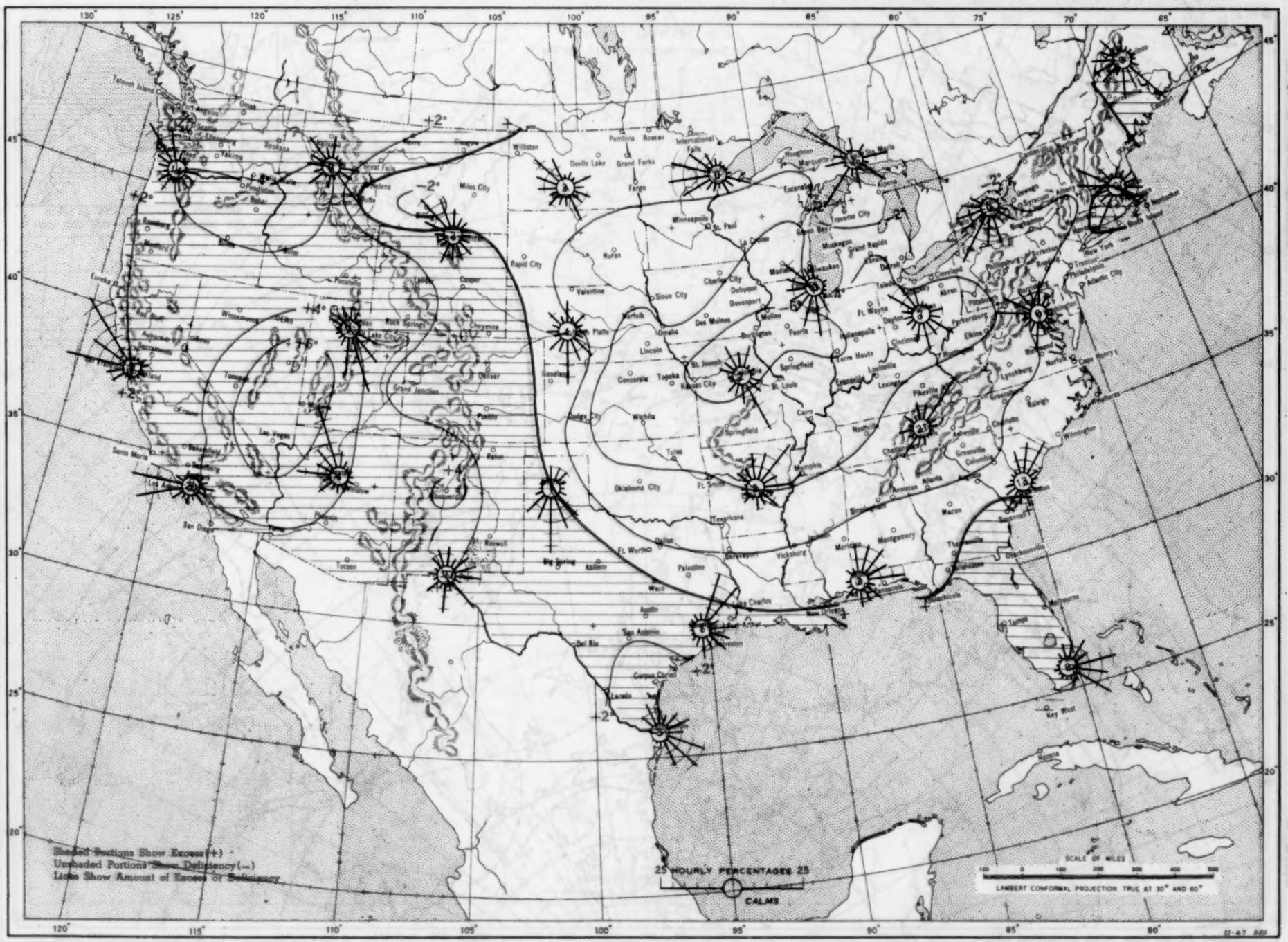
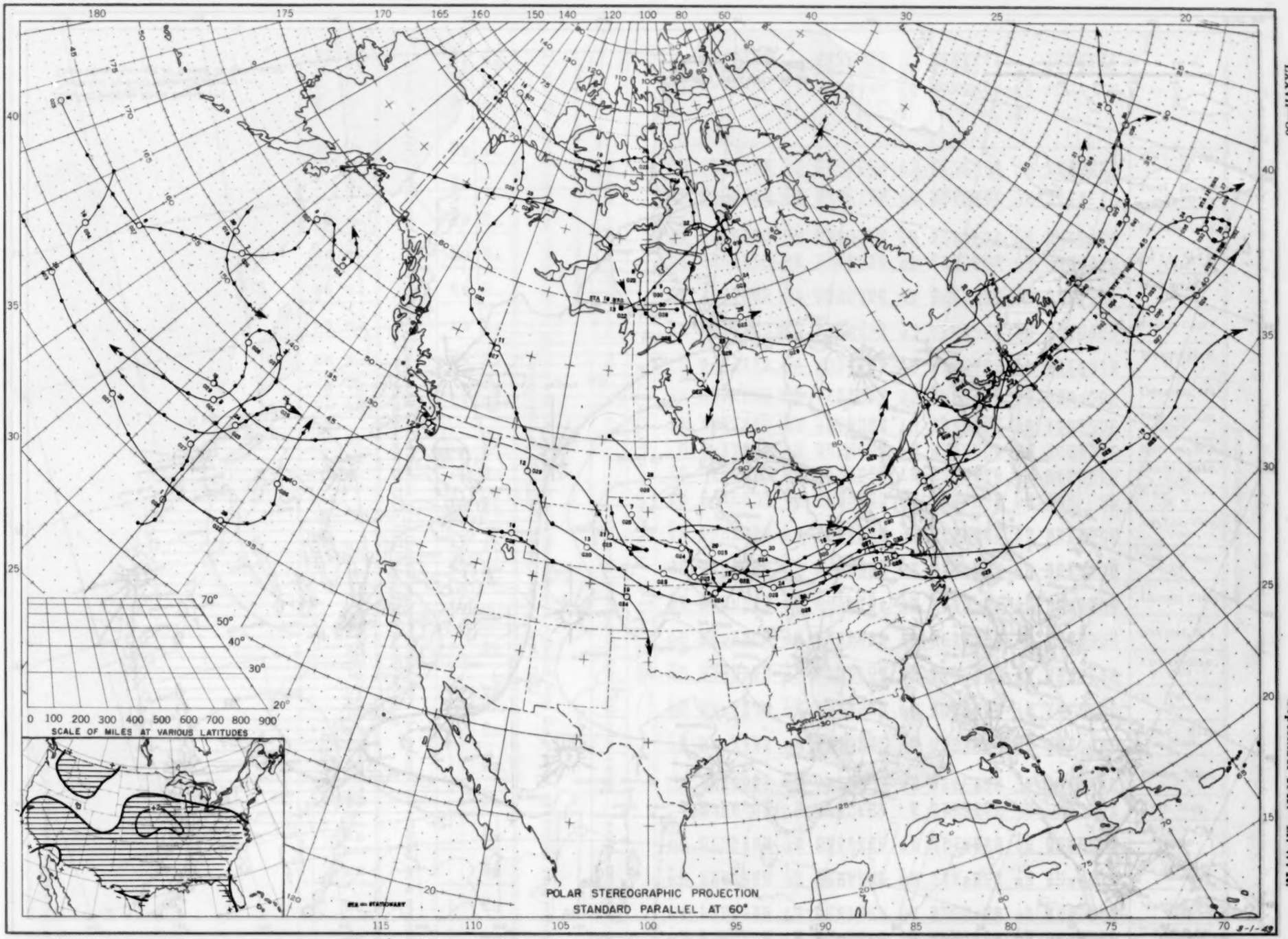
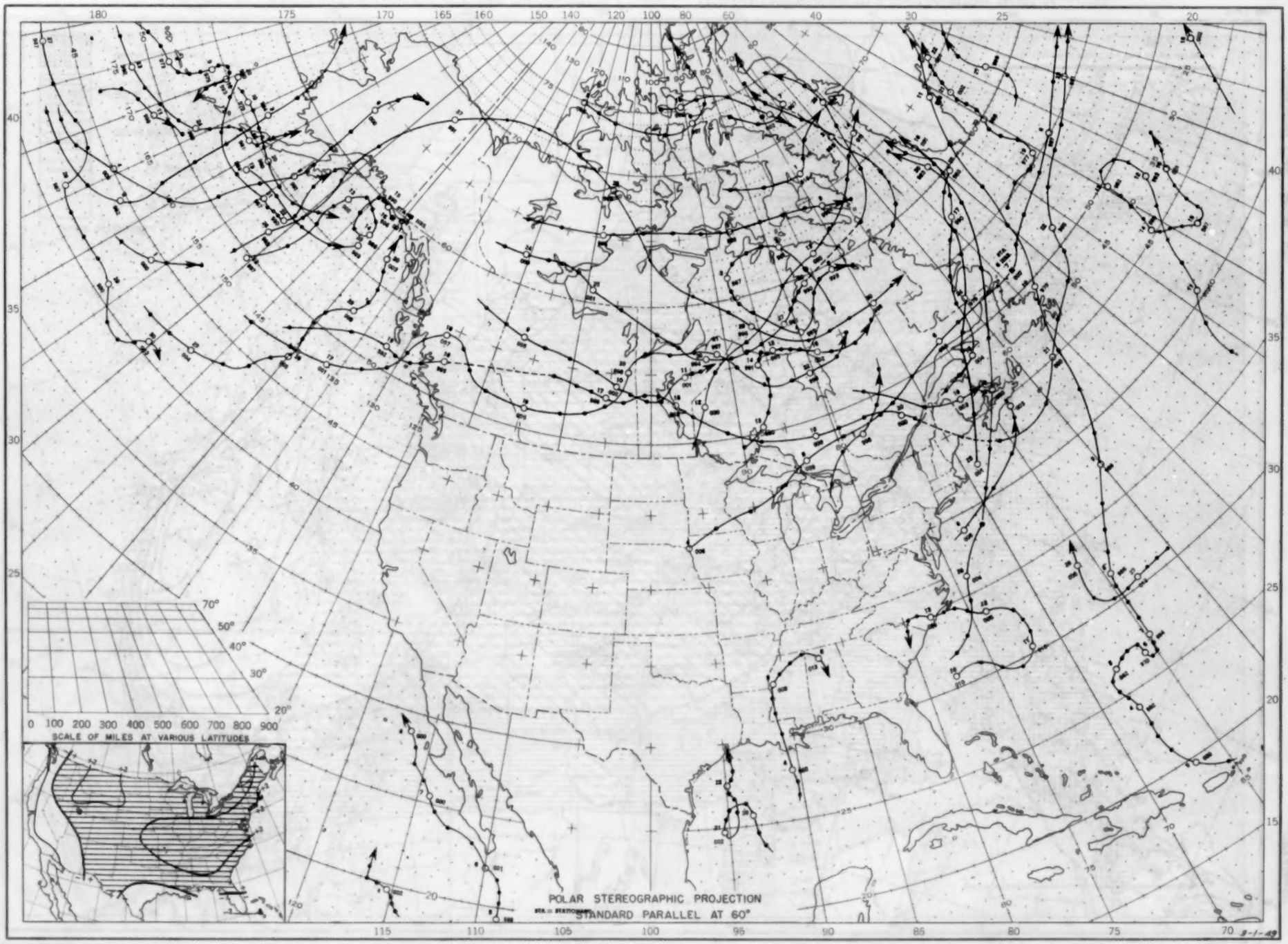

Shaded Portions Show Excess (+)
Unshaded Portions Show Deficiency (—)
Lines Show Amount of Excess or Deficiency
25 HOURLY PERCENTAGES 25
CALMS
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Chart II. Tracks of Centers of Anticyclones, September 1949. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time). Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.

Chart III. Tracks of Centers of Cyclones, September 1949. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time) Dots indicate intervening 6-hourly positions. Figure above circle indicates date, and figure below, pressure to nearest millibar. Only those centers which could be identified for 24 hours or more are included.

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, September 1949

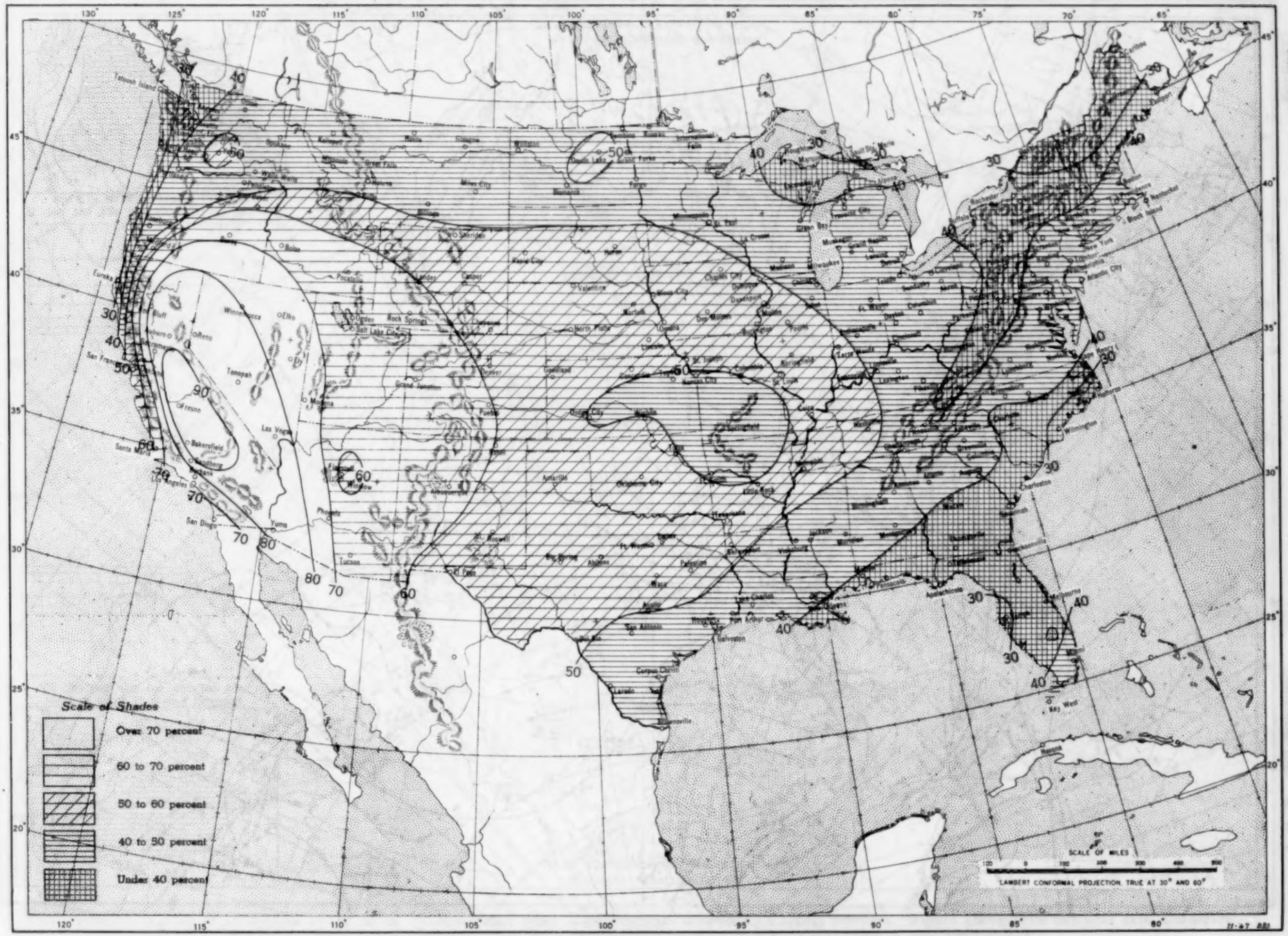

Scale of Shades
Over 70 percent
60 to 70 percent
50 to 60 percent
40 to 50 percent
Under 40 percent
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION, TRUE AT 30° AND 60°

Chart V. Total Precipitation, Inches, September 1949. (Inset) Departure of Precipitation from Normal

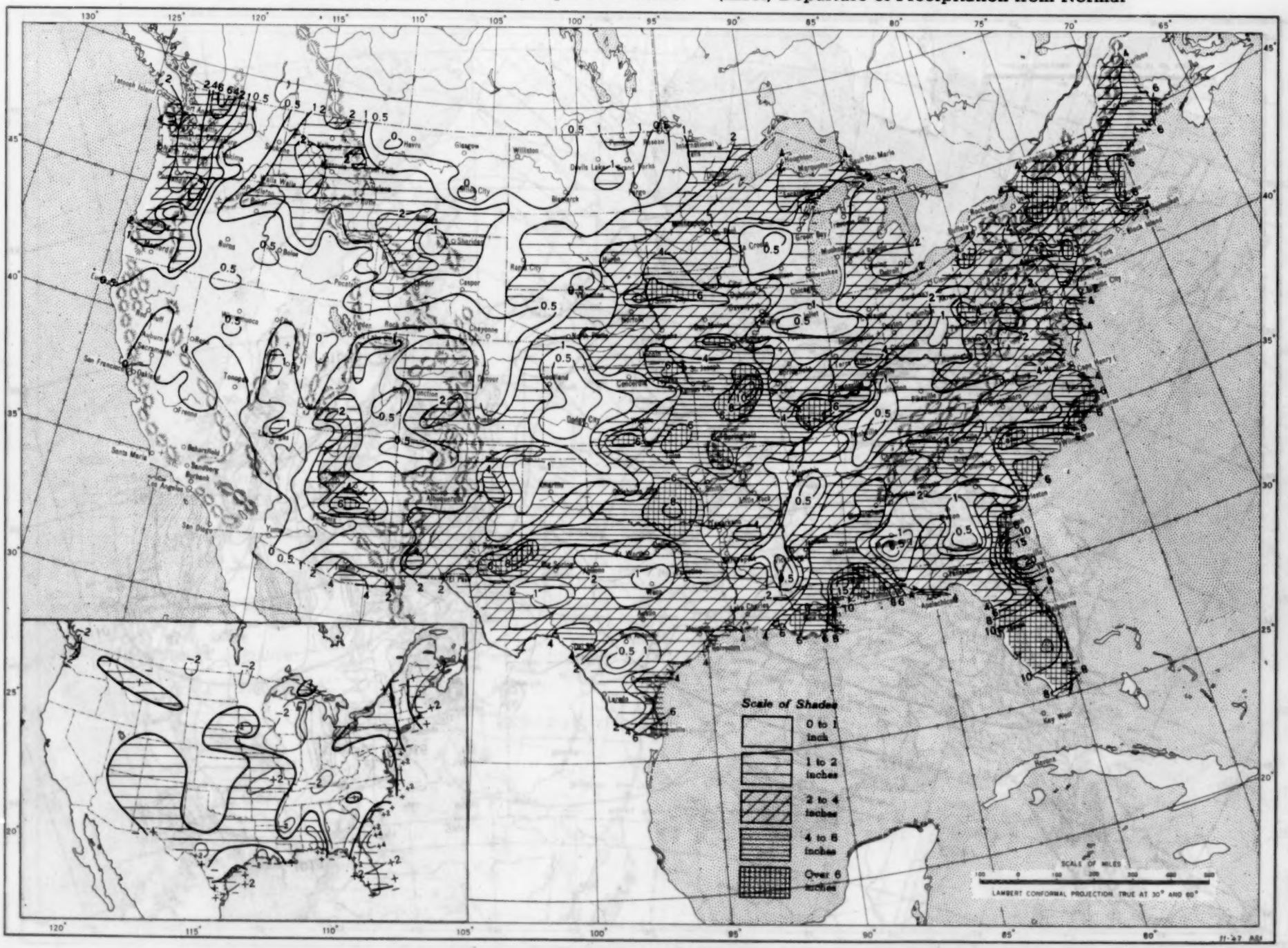

Scale of Shades
0 to 1 inch
1 to 2 inches
2 to 4 inches
4 to 6 inches
Over 6 inches
SCALE OF MILES
LAMBERT CONFORMAL PROJECTION TRUE AT 30° AND 60°

Chart VI. Mean Isobars (mb.) at Sea Level and Mean Isotherms (°F.) at Surface., September 1949

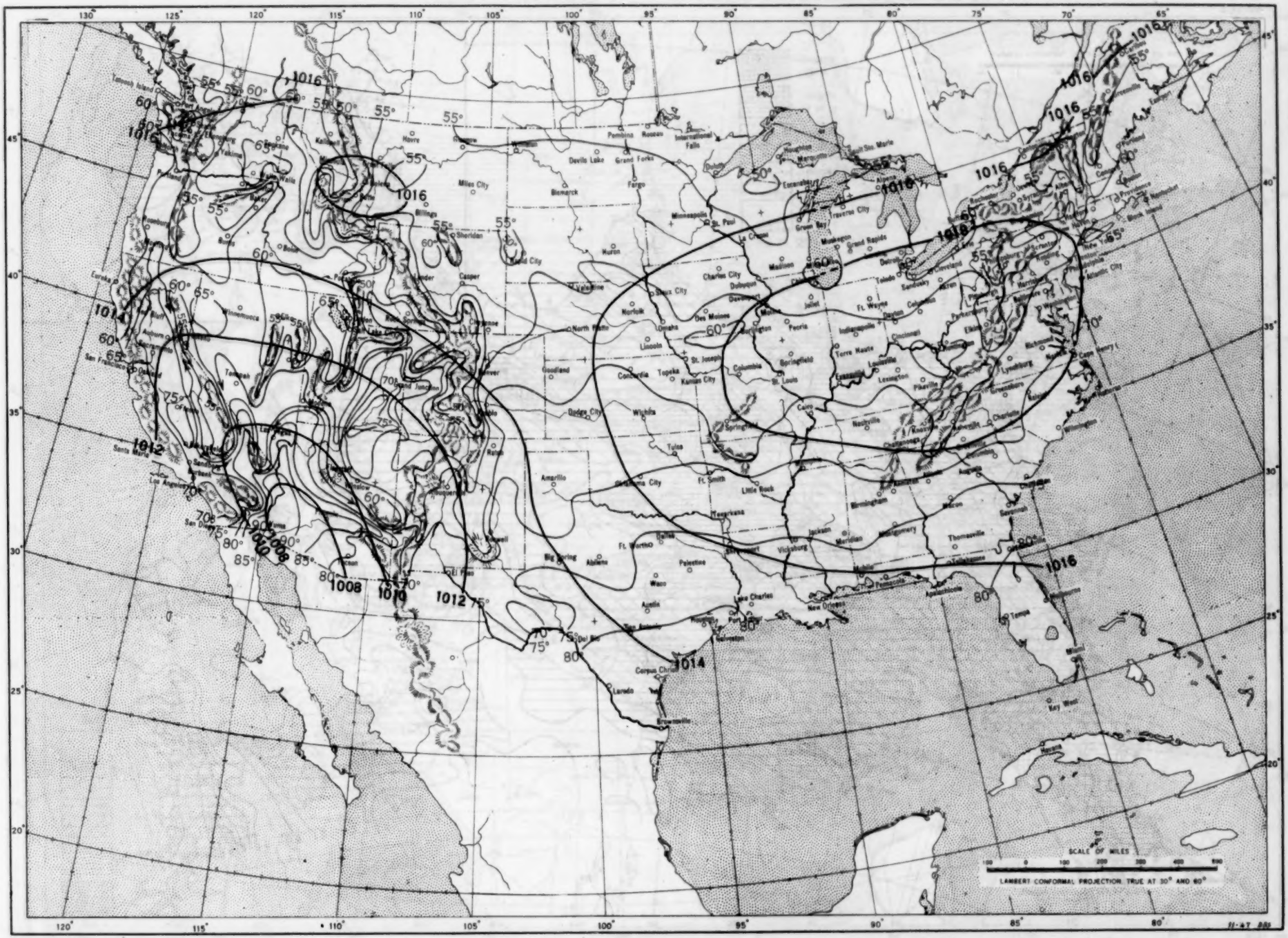
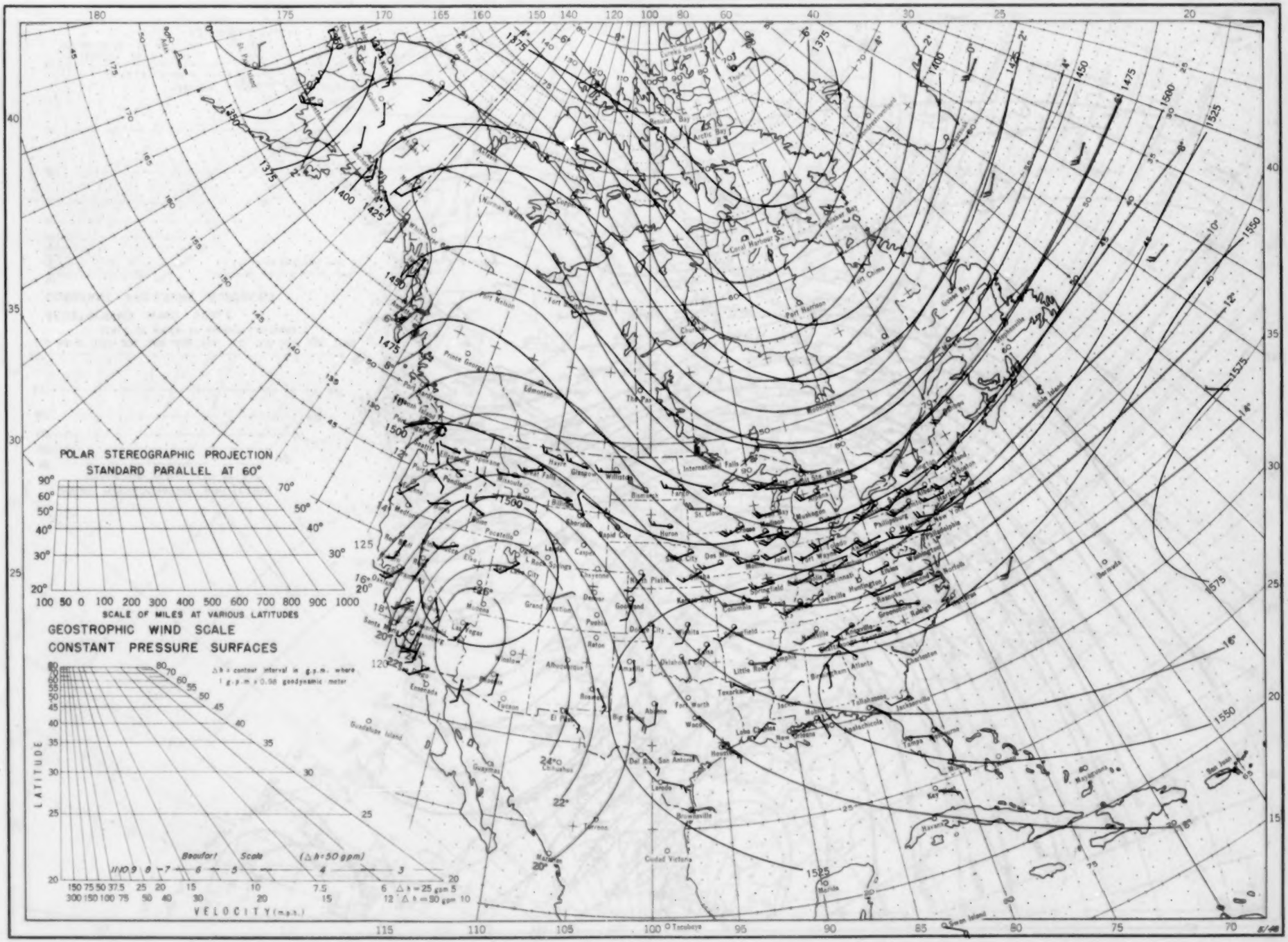


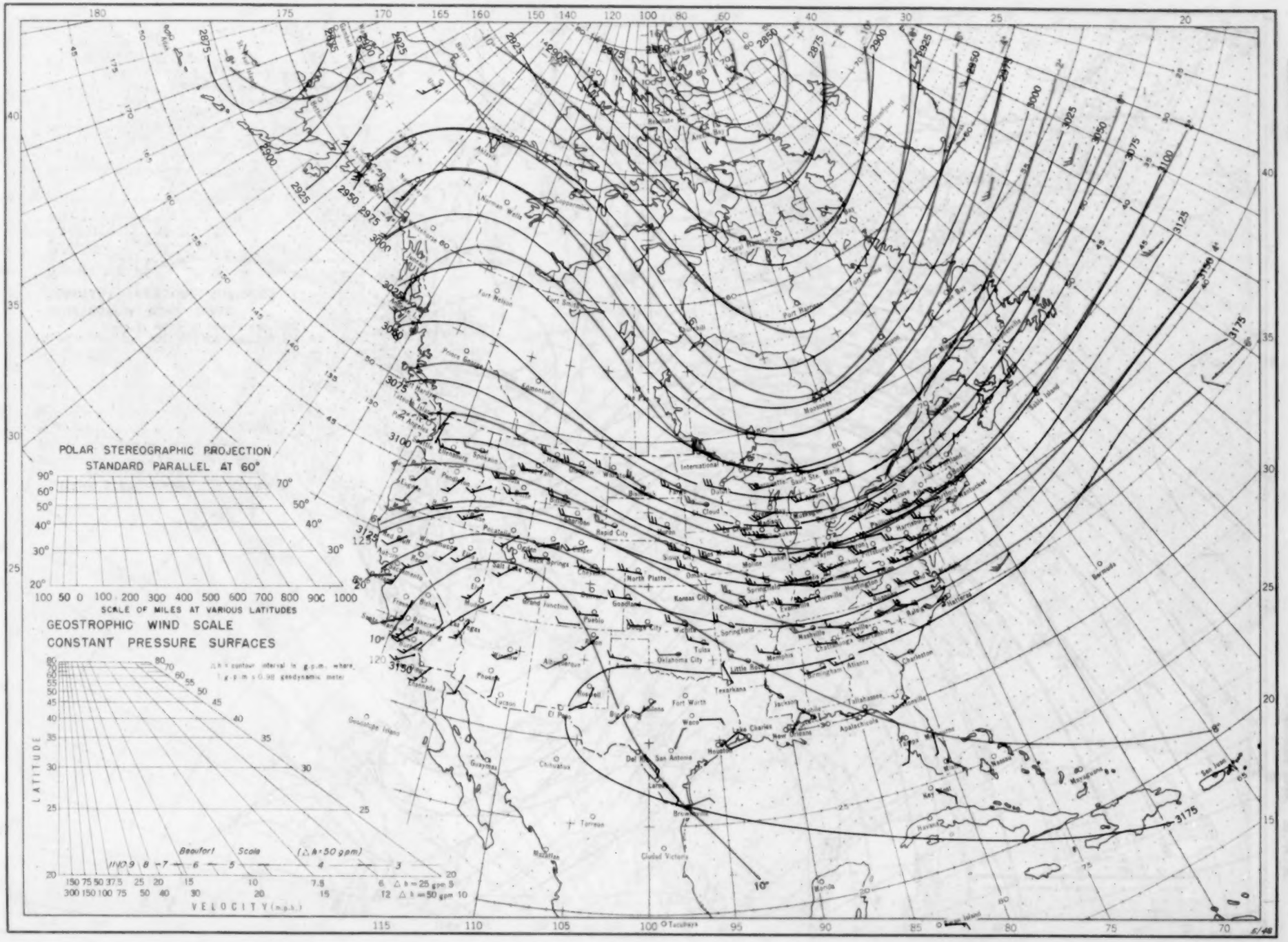
Chart VIII, September 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850 millibar Pressure Surface, and Resultant Wind at 1,500 Meters (graph)

Chart VIII, September 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s. l.)


POLAR STEREOGRAPHIC PROJECTION
STANDARD PARALLEL AT 60°
SCALE OF MILES AT VARIOUS LATITUDES
GEOSTROPHIC WIND SCALE
CONSTANT PRESSURE SURFACES
LATITUDE
VELOCITY (m.p.h.)
Beaufort Scale
Δh = contour interval in g.p.m. where 1 g.p.m. = 0.98 geodynamic meter

Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

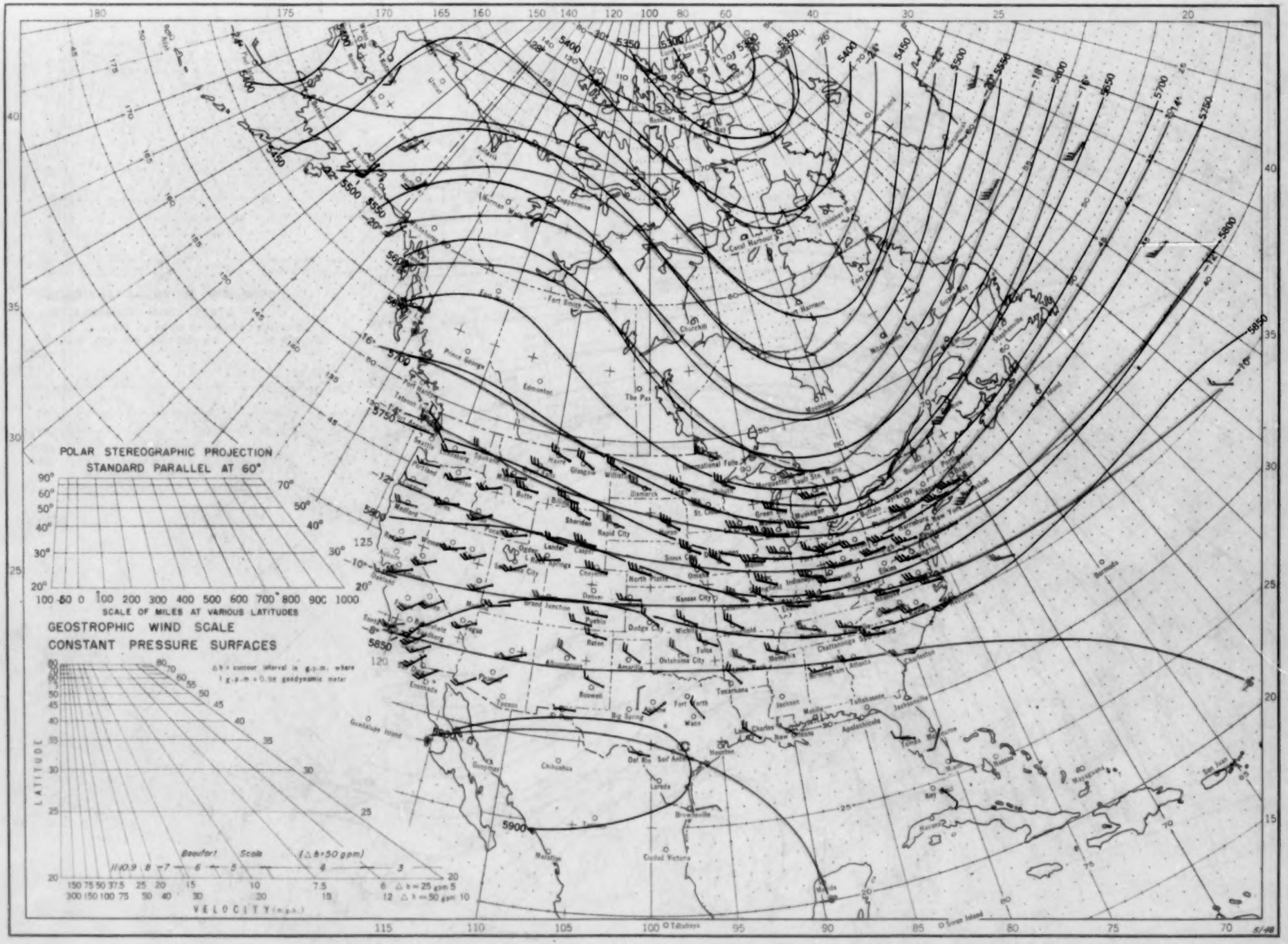
Chart IX, September 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 700-millibar Pressure Surface, and Resultant Winds at 3,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

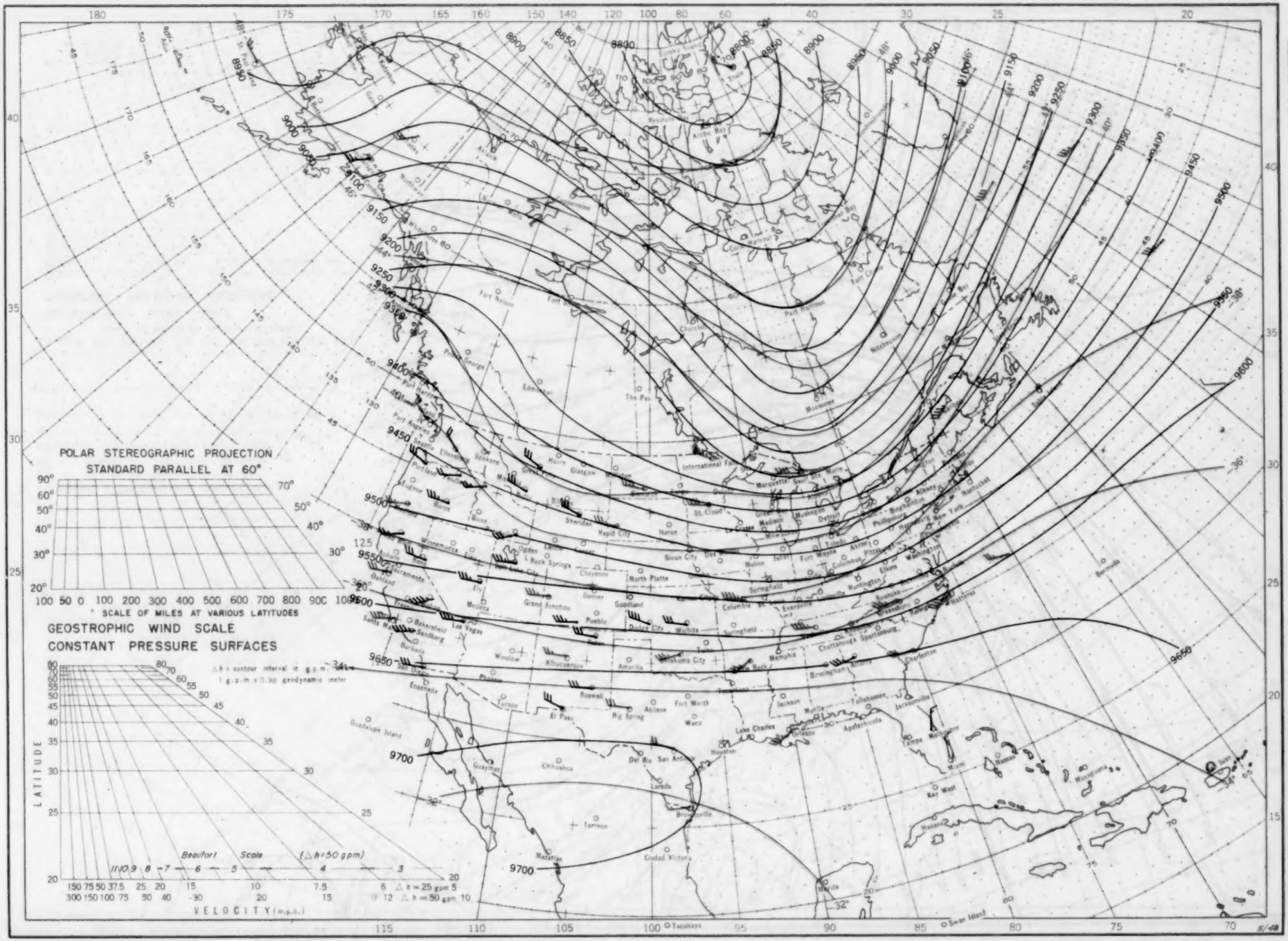
Chart X, September 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean

Chart X, September 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

Chart XI, September 1949. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s. l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2200 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.